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SPECIAL ARTICLE.

ON THE EXTERMINATION OF THE MOSQUITO.

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The investigation of the mosquito in the United States during the past few years has contributed much valuable information regarding the propagation of this insect, its habits, its relation to disease, and the means by which it can be exterminated. This has been particularly satisfactory, inasmuch as those who have been active in the investigation, and who have worked independently of each other, have arrived at practically the same conclusions, which is additional evidence of the value and thoroughness of the work. The results obtained in Havana by Dr. Walter Reed and his associates, who composed the Board appointed by the United States Government to investigate the cause of yellow fever, must be regarded as conclusive evidence that this disease is transmitted by the variety of mosquito known as the *stegomyia*, and thus far no evidence has been presented to show that it is transmitted in any other way. The value of this discovery cannot be overestimated, inasmuch as it points out the means by which the propagation of yellow fever may be prevented. It has also given an impulse to further investigation of the mosquito in this country, although the more recent investigation has rather been directed toward securing such information as will lead to the extermination

of this insect. We are now familiar with practically every variety of the mosquito which propagates in the United States, or at least those varieties which usually annoy us, among which are found two varieties known to transmit disease, viz., the *stegomyia* (yellow fever) and the *anopheles* (malarial fever). Thus far no evidence has been presented to show that other mosquitoes found in the United States act as a medium of infection. While the *anopheles* may be found throughout the United States the *stegomyia* is found only in the southern portion of it, which will explain why the propagation of yellow fever is confined to that section of the country. The most recent investigation of this subject relates to the *culex sollicitans*—commonly known as the "striped-legged," "salt-water," or "Atlantic coast" mosquito—of which but little has heretofore been known. This mosquito constitutes about 80 per cent. of those found along the Atlantic coast, and is the chief source of annoyance in the section referred to.

Until recently the extermination of the mosquito has been regarded as practically impossible, and within the past five or six years the propagation of certain species of birds, etc., for the purpose of diminishing the number of these insects, has been seriously suggested by those whose opinions are entitled to careful consideration. Indeed, efforts to exterminate the mosquito have heretofore been looked upon largely from a humorous point of view.

Careful investigation has shown that the extermination of the mosquito is not only practical, but can be successfully accomplished; besides, the public now know that the extermination of the mosquito is not alone for the purpose of preventing the annoyance which the bite of this insect inflicts, but also to prevent the transmission of disease. Therefore, to a considerable extent, the co-operation of the public has been secured in this important work.

To obtain success in our efforts to exterminate the mosquito we must be familiar with the manner in which it is propagated, its habits, etc. First, we must understand that all varieties of the mosquito propagate only in water. The importance of this lies in the fact that it gives us definite information regarding the character of their breeding places. Thus far investigation has shown that all mosquitoes, with the exception of the *sollicitans*, deposit their eggs on the surface of the water. These develop into larvæ, commonly known as "wigglers," and then into pupæ, which are subsequently transformed into the winged insects. From the deposit of the eggs to the development of the winged insect only twelve to twenty-five days elapse, depending on the variety of mosquito. The longest period is, as a rule, required for the development of the *anopheles*, or malarial mosquito. Until recently it has been the general belief that mosquitoes deposit their eggs only upon the surface of the water. The investigation of Dr. John B. Smith,

State Entomologist of New Jersey, and the investigation under my direction have satisfactorily demonstrated the fact that the *sollicitans*, when free to act, deposit its eggs on the ground in the salt marshes along the coast, although in captivity this mosquito may deposit its eggs on water, glass, cotton, or on almost anything with which it comes in contact. However, even in captivity, it will be found that, if earth from salt marshes be placed in cages containing the *sollicitans*, it will preferably deposit its eggs on this material, however the development of the eggs do not take place until the earth is covered with water. In the salt marshes this is supplied by the frequent floodings, which form both small and large collections of water; many of these remain sufficiently long for the development of the winged insect. Therefore, while the eggs of the *sollicitans* are deposited on the earth in salt marshes, their development into the winged insects depends upon the presence of water in the same manner required by other varieties of the mosquito.

PROPAGATION OF THE MOSQUITO.

Culex Pungens. The *culex pungens*, the "inland" or "fresh-water" mosquito, is probably the most common variety of this insect with which we come in contact throughout the United States. It will breed in almost any receptacle containing water—commonly in cisterns, rain-water barrels, tin cans and other metal, glass, and wooden receptacles, roof leaders, crotches of trees, and in the most unsuspected places. My experience has shown that the propagation of this variety of mosquito is, as a rule, most active in stagnant and offensive water, which contains considerable organic matter. Two rather remarkable instances have recently come under my observation, where broken sewer pipes discharged their contents into ground depressions, resulting in collections of offensive water. In the immediate vicinity of these were pools of rain water, which were not contaminated. In both instances it was found that the sewer water soon became exceedingly rich in mosquito larvæ (culex pungens), whereas in the other pools, but a short distance away, and which contained comparatively clear water, there were few, if any, larvæ found. I have found additional proof of this in the following experiments: Large superficial wooden tanks were employed, in which water of various kinds were placed—*i. e.*, rain water, hydrant water, water in which decomposed meat, fish, etc., had been added. These tanks were exposed side by side in a section infested with mosquitoes. In all the tests it was shown that the deposit of mosquito eggs was always more numerous in tanks containing the offensive water. Experiments on a smaller scale were also made; pails and glasses were exposed, which contained the

different kinds of water already referred to, with the same results—viz., the deposit of the eggs was much greater in the offensive water. These experiments were repeated many times with the same result, and are in harmony with the natural conditions, which I have found in districts infested with the *culex pungens*. Thus far I have found no evidence to prove that this variety of the mosquito will deposit its eggs on salt-water.

Anopheles or Malarial Mosquito. The anopheles, while it may sometimes be found breeding in the same receptacle with the *culex pungens*, generally selects for its breeding place small pools of water, commonly permanent ones, which are not contaminated, and which are frequently covered with green scum, or in water contained in small ground depressions, along the edge of swamps or pools of water, which are fed by springs, or in unused receptacles about the house.

Culex Sollicitans. The belief that no mosquito will breed in salt-water is erroneous, inasmuch as the *culex sollicitans* will breed in no other place. Therefore, while we suffer the annoyance which the bite of the *sollicitans* inflicts, it may be of some comfort to know that they will not breed inland or away from salt marshes. The statement just made regarding the *sollicitans* has been corroborated by careful investigation and experimental work which I have conducted during the past five years. During this period specimens of water containing larvæ taken from all kinds of receptacles about dwelling houses, ground depressions, etc., either in close proximity or some distance removed from salt-water swamps, were placed in large glass receptacles, covered with netting, and allowed to remain until the winged insects were developed, but in no instance did the *sollicitans* develop from these larvæ. A number of times larvæ have been taken from inland drains, the immediate vicinity of which was thickly infested with the *sollicitans*, but the larvæ always developed into the *culex pungens*, or "inland" mosquito, and no *sollicitans* were ever found. The result of these observations gradually directed attention to the salt marshes along the coast as the seat of propagation of the *sollicitans*. Here in the pockets, or ground depressions containing salt-water, the larvæ of this variety were found in enormous numbers, this was proven by placing the water containing larvæ in large glass jars covered with netting. When the winged insects appeared they were in every instance found to be the *sollicitans*, and no other variety. A series of experiments which followed consisted in the transfer of earth from these swamps to the laboratory, where it was placed in large glass jars covered with netting. In these were confined the *sollicitans*. Soon after their captivity eggs were found deposited on the earth. After the release of the mosquitoes the earth upon which the eggs had been deposited was kept intact and allowed to

remain for various periods, in some instances for four months. In some of the tests the earth was kept moist; in others it was allowed to dry, but in no instance was there any further development of the eggs until the earth was covered with water; then, within twelve hours afterward, the larvæ appeared. Other experiments consisted in placing earth from salt-water marshes in wire cages also containing water in glass jars. The *sollicitans* in the cages preferably deposited their eggs on the earth rather than on the water. The results to which I have referred are in harmony with those obtained by Dr. John B. Smith, to whom credit is due for exceedingly valuable work in connection with this variety of mosquito.

As a result of these investigations it is reasonable to assume that the *culex sollicitans* breeds only in salt-water swamps, and that their eggs are deposited upon the earth and remain without further change until covered with water, when the developments of the winged insect rapidly follows. It is also reasonable to assume that the first crop of the *sollicitans*, which appear in the spring or early summer, is due to the hibernation of the eggs of this insect, which are deposited on the ground late in the fall, but do not develop until the warm weather of the following year appears, and the swamps are more or less covered with water.

On the other hand it is equally certain that the *culex pungens*, or "inland" mosquito, is perpetuated by the hibernation of the winged insect itself, and not by its eggs. It is a frequent occurrence in sections where this variety of the mosquito breeds to find a few of them about the house during the winter months. When the warm weather appears the survivors become active and deposit their eggs in receptacles containing water. It is not impossible that a few larvæ of this variety may hibernate during the winter, as in some instances they have been detected in ice, warmed and brought to life. However, I have never known of one which survived more than a short time, and I am quite certain that they do not play an important part in perpetuating their species. The statement which I have just made relative to the perpetuation of the *culex pungens* may, I believe, be also applied to the *anopheles* and *stegomyias*, although regarding the latter variety I do not speak from personal experience.

There is good reason to believe that the *stegomyia*, or yellow-fever mosquito, like the *culex pungens*, prefers to breed in contaminated water.

Psorophora Ciliata. It may be of interest to refer to my investigation concerning the variety of mosquito known as the *psorophora ciliata*. This variety is very large, probably three or four times the size of the ordinary mosquito; however, it is not frequently seen in this section of the country, and consequently is not much of a factor in the annoyance caused by these insects. I was fortunate

enough during the past summer to secure four or five of this species. They were placed in captivity and many eggs were secured. The latter are not, like the eggs of the *culex pungens*, laid in floats consisting of three or four hundred, but in a manner similar to that of the *culex sollicitans*, which are fewer in number and separate from each other. In this instance the eggs developed into the larvæ in the ordinary way. These, however, gradually disappeared, and, after careful examination, it was found that *psorophora ciliata* is predatory and that the larvæ devour each other, and it was only by the introduction of plenty of larvæ of the *culex pungens*, which are much smaller and furnished sufficient food, that the larvæ of the former were preserved and some winged insects obtained. It is not improbable that the predatory habits of this variety will in a measure explain why there are so few of them.

LIFE OF THE MOSQUITO.

A general impression exists that the life of the mosquito is very short, probably a few days only. This is erroneous. While it is true that the mosquito is not a resistent insect and easily succumbs to all sorts of influences, it is a fact that it lives for some time. In the hibernating stage we know that it may live from fall until the following spring, and during the warm weather, or in its active stage, it may live a number of weeks. It is practically impossible to arrive at any definite conclusion regarding this part of the subject, inasmuch as experiments do not furnish satisfactory evidence, for the reason that they cannot be carried out under natural conditions. In other words, mosquitoes may die from captivity or fright, or when they are unable to select the character of food which they require. It is safe to assume, however, that if they live a certain period in captivity they will live equally long when they are free to go and come as they please. There have been many investigations made and published on this point which proves that mosquitoes will live for weeks in captivity. I have kept them under observation in wire cages with nothing but sugar-water for two months. They may be kept for a long period in captivity without food or water, provided air and light be present. Aside from the importance of securing definite knowledge in this direction, the length of time which mosquitoes may live in close confinement without air or light has an important practical bearing, as it has been claimed that yellow fever may be transmitted from one place to another through the agency of infected *stegomyia*, or yellow fever mosquito, confined in baggage, etc. In order to secure so far as possible definite information regarding this part of the subject, the following experiments were made:

A number of boxes, canvas bags, and other receptacles were filled with clothing, blankets, bedding, etc. When these were made ready mosquitoes were collected in the following manner: Horses were taken to a district thickly infested with mosquitoes, where they were soon covered with these insects; over which were placed test tubes, in order to secure the mosquitoes uninjured. When a sufficient number were caught in this manner, the opening of the tubes were filled with light cotton plugs, and within a short time afterward the tubes were introduced into the receptacles already described, the cotton plugs removed, and the tubes gradually withdrawn, being shaken sufficiently to drive out the mosquitoes. In this manner, from the time of the capture of the mosquitoes until their introduction into the receptacles, they were neither handled nor in any way injured; certainly, no more than they would be if imprisoned during the process of packing. A careful record was kept of the number of mosquitoes in each receptacle in order that all could be accounted for, and although many experiments were made, it was found that in no instance did the mosquitoes survive the confinement longer than thirty hours. I believe, therefore, that the treatment of baggage coming from yellow-fever ports is unnecessary, provided the period of transit exceeds two days.

DISTANCE WHICH MOSQUITOES TRAVEL.

Considerable difference of opinion exists in regard to the distance which mosquitoes travel. While there is sufficient proof that they are sometimes found a long way from home, careful investigation has shown that, with the exception of the *culex sollicitans*, they do not willingly go far from their breeding place. The fact that the *sollicitans* breeds only in salt-water swamps along the coast and are always found some distance inward is evidence enough that this is the habit of the *sollicitans*, and is not due to accidental causes. However, the *culex pungens*, *anopheles*, and the *stegomyia* are notoriously home mosquitoes and remain in close proximity to their breeding place, unless forcibly removed by winds, etc., and there is no doubt that the difference of opinion, which exists in reference to this part of the subject, particularly in regard to the varieties just referred to, is due principally to the fact that local breeding places are frequently overlooked. When it is remembered that the female of the *culex pungens* variety will lay three or four hundred eggs at one time, and as it only requires from twelve to twenty-five days for eggs to develop into a winged insect, it is not difficult to understand how a small receptacle will breed a large number of mosquitoes. Therefore we should first examine every part of our premises to discover the breeding

places of mosquitoes before we look elsewhere for them. As a matter of fact, these are usually found in the most unsuspected places. I will cite an instance occurring in my own experience some time ago. My attention was called to a number of cases of malarial fever occurring in two or three houses in close proximity to each other. *Anopheles* were found in the rooms of these dwellings during the evening. In the immediate vicinity of the houses were found numerous pools of water, rain-water barrels, and other receptacles containing water, which were examined with great care, but no *anopheles* larvæ found. Continued investigation was made and in the garden of a vacant house adjoining those where malarial fever existed was found an old cake pan, almost entirely covered with long grass, but filled with *anopheles* larvæ. An ordinary inspection would probably not have discovered this receptacle.

EXTERMINATION OF THE MOSQUITO.

Careful investigation of the mosquito has shown that the various types of this insect differ in their method of propagation, habits, etc. It is very necessary that we should be familiar with this fact, inasmuch as the means by which the mosquito may be exterminated depend largely upon the variety with which we have to deal.

The importance of our present knowledge regarding the *culex sollicitans* will be better appreciated by those who live along the Atlantic coast, and who are constantly subjected to the annoyance of this variety of the mosquito during the warm weather. It is a well-known fact that the enormous number of *sollicitans* present has seriously interfered with the development of certain sections along the Atlantic coast. Before its breeding place was definitely known efforts to prevent its propagation were confined to the same means which are used to exterminate the *culex pungens*, *anopheles*, and *stegomyia*, such as the care of inland ground depressions, cisterns, rain-water barrels, and other receptacles. We now know that such methods as these are practically useless in the extermination of the *sollicitans*, and it is only by the proper drainage of salt-water swamp lands along the coast that the propagation of this variety can be prevented. The use of oil in the extermination of this variety of mosquito even as a temporary measure is but of little or no value. Although the *sollicitans* deposits its eggs on the ground in the swamps, they cannot develop without water, and, if accumulations of surface water is prevented by drainage, propagation ceases. This has already been successfully demonstrated in some of the New Jersey salt-water swamps, which were impassible and thickly infested with mosquitoes. These have recently been ditched and drained, and this year are producing

crops of hay, which are harvested with mowing machines. Furthermore, the mosquito has practically disappeared in the sections thus treated. Work of a similar character is now in progress along the Staten Island coast, and it is confidently expected that next year will prove the success of this work.

In inland districts which are infested with the *culex pungens*, and other "fresh water" or "inland" mosquitoes, it is imperative that the public should be instructed not only in regard to the necessity for drainage and filling in where land depressions exist, but also the importance of removing so far as possible from dwelling houses and other buildings and about the premises all sorts of metal, glass, and wooden receptacles which contain water and which may act as breeding places. This policy has been carried out during the past summer in connection with the mosquito work on Staten Island. About ten thousand circulars were distributed throughout the residential portion of the Island, giving general information in regard to this mosquito, its breeding places, and the means by which it may be exterminated. The result has shown that this method of securing the co-operation of the public is practical and successful. Cisterns and rain-water barrels contribute largely toward the propagation of the *culex pungens*. If more modern means of securing water cannot be substituted, these receptacles should be supplied with tight-fitting covers, the centre of which may be constructed of wire netting to admit air. Roof leaders should be kept properly graded, otherwise parts of them may act as breeding places. If ground depressions either about the premises or in the neighborhood cannot be drained or filled in, petroleum oil may be used as a temporary measure. The crude petroleum, of which the so-called "Lima" oil is a type, is probably superior to the refined oil, and should be used in proportion of one pint of oil to a water surface of about twenty feet in diameter. Even a less amount of oil may be effective. This procedure should be repeated every two weeks. The method by which the oil destroys the larvæ, or "wiggler," is probably not by a toxic effect, but by a mechanical one. The larvæ must come to the surface of the water for air every minute or two. If watched carefully it will be noticed that the *culex* approach the surface of the water at right angles with the tail uppermost and extended somewhat above the surface, the air being taken in at this end. The *anopheles* larvæ may be distinguished at this stage, for the reason that they do not lie at right angles to the surface of the water, but underneath and parallel to it, and receive the air by projecting the head above the water instead of the tail. It is probable that the oil thrown on the surface obstructs the delicate respiratory apparatus of the larvæ and rapidly suffocates them. This is largely corroborated by experiments. If a small amount of petroleum oil is thrown over the surface of the water in a glass jar containing

larvæ the latter will succumb in from ten to twenty minutes; toxic agents kill them very slowly, as careful investigation has proved. The odor of petroleum oil is evidently very unpleasant to the winged insect, inasmuch as the exposure of this agent diminishes the number of mosquitoes present. In treating water surfaces with petroleum the ordinary garden sprinkling-pot, with the openings in the nozzle somewhat enlarged, is a good and practical method of distributing it. My experiments with permanganate of potassium, bichloride of mercury, sulphate of copper, carbolic acid, etc., have shown that these agents are greatly inferior to petroleum for the purpose of destroying larvæ. Their action is slow, and the mosquito larvæ live in comparatively strong solution; for instance, larvæ have remained more or less active from one to two days in a 1:1500 solution of bichloride of mercury. Even comparatively strong solutions of carbolic acid or permanganate of potassium do not destroy them for some time. In some very exhaustive experiments made with sulphate of copper and lime for the destruction of mosquito larvæ, etc.,[1] I found that these agents did not destroy the mosquito by a toxic effect, but slowly by clarifying the water and precipitating the organic matter, which was contained in the receptacle, thereby removing the nourishment upon which the larvæ depended. It must be remembered that pools of water throughout the country may be used for drinking purposes, by animals, and that the use of such agents as bichloride of mercury, carbolic acid, etc., are therefore unsafe and should never be used. On the other hand, petroleum oil is cheap, practically harmless, and destroys the larvæ at once, and, so far as we know at the present time, is superior to anything else as a temporary measure.

Mosquitoes are most active after sundown. During the day they often select for their abiding place the high grass and underbrush. Therefore this material, so far as possible, should be removed in mosquito-infested districts.

It is apparent from a careful study of this subject that all varieties of the mosquito cannot be exterminated by the same means. For instance, in the case of the *sollicitans*, it is absolutely necessary that the work of extermination should be carried out under municipal, State, or Federal control in order to insure uniform and successful results. Ditching or draining here and there according to the will of individual owners of salt-water swamp land will only end in failure to successfully exterminate this variety of the mosquito. On the other hand, the extermination of the *culex pungens*, *anopheles* and *stegomyia* depends largely on the efforts which are made by individual property owners or tenants to prevent the propagation of this mosquito in receptacles about the premises, as well as the draining and filling in of ground depressions.

[1] Medical Record, January 31, 1905.

The theory that filth favors the propagation of yellow fever is entitled to the most respectful consideration, inasmuch as bad drainage, and the accumulation of fluid filth, etc., furnishes the breeding place for the *stegomyia*. Since the knowledge has come to us that the mosquito is the medium by which yellow fever is transmitted, the fact that filth contributes indirectly to this disease has unfortunately been overlooked.

CYSTINURIA.

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The occurrence of cystin in the urine has attracted the attention of many investigators, and more or less complete attempts have been made to control the metabolism and to explain the relationships of this most curious metabolic anomaly.

In 1876 Loebisch[1] undertook what was for that time a careful investigation of the condition, and showed, in contradistinction to the findings of the older observers, cystin was not increased at the expense of the uric acid.

Later Mester,[2] under Baumann's guidance, had the opportunity of examining, during a long period, a pronounced case of cystinuria, in which he was able to control the diet. It cannot be said that the results of Mester throw any very distinct light on the effects of various procedures, such as diet, alcohol, massage, on the excretion of the cystin.

More recently, however, renewed attention has been directed to the condition by the work of Mörner,[3] who has demonstrated that the cystin group is a constituent of all protein substances, and of Friedmann,[4] who has cleared up the chemical constitution of cystin.

From a physiological point of view the subject of cystinuria has come into the front rank of importance through the recent and very remarkable results of Loewy and Neuberg.[5] If the results of these investigators hold, and the theories advanced as a consequence of this work be correct, they have contributed a very fundamental research to the physiology of nutrition.

As, however, their results have not been confirmed by other observers,[6] any light which can be thrown on this important anomaly is of value. It is for the purpose of contributing to the meagre data obtaining that the following two analyses of the urine are given.

Loewy and Neuberg found that in a case of cystinuria the patient was not able to oxidize ordinary cystin to sulphates when given per os, which is normally the case.[7] The cystin was excreted quantitatively by the urine.

An isomeric cystin which they obtained from a cystin calculus in their possession was completely assimilated.*

Furthermore, although the amino acids, leucin and tyrosin, were not found in the urine; when these substances were administered by the mouth, they passed unchanged into the urine. They, too, are normally excreted in the form of urea and other nitrogenous derivatives. The diamino acids, arginin and lysin, which are also changed to urea, were not eliminated as such, but were changed to the diamins, putrescin, tetramethylendiamin, and cadaverin, pentamethylendiamin. This was an important observation, because, since Brieger, several investigators had found the presence of diamins in the urine and in the stools of patients suffering from cystinuria. This is also the case in the present instance.

From the results which Loewy and Neuberg obtained they drew the following conclusions regarding normal nutrition.

They concluded first of all that, as under normal conditions the cystinuric does not excrete amino acids, with the exception of cystin, or diamins in his urine, and as on feeding these substances or their precursors they appeared quantitatively in the urine, under normal conditions little or no cleavage of proteins to amino acids took place in the intestine.

They also concluded that it would be possible to determine the extent of cleavage by feeding successively the cleavage products of proteins, the albumoses and peptones, etc., and the appearance of one of these products in the urine would mark the boundary line between normal digestion in the intestine and artificial proteolysis *in vitro*.

If this view were correct it would upset the prevalent conception of digestion, in which the ultimate cleavage products of the proteins, the amino acids, leucin, tyrosin and the rest are supposed to play such an important part.

Unfortunately for this attractive theory a recent paper by Alsberg and Folin[8] has utterly failed to confirm their results.

These investigators instituted the most careful and accurate examination of the metabolism of a cystinuric which has so far been accomplished. They were able to control the diet perfectly, and the results which they present are equally as convincing as those of Loewy and Neuberg. They show on their side that the cystinuric patient with whom they were dealing was perfectly able to oxidize amino acids to urea and cystin to sulphates. Moreover, the very

* The cystinuric, therefore, was incapable in a very especial degree only of assimilating the cystin group, for he reacted with the isomeric cystin in identically the same way as does the normal individual.

important fact was brought out in their results that while the administration of proteins very notably increased the amount of neutral sulphur, and by inference the cystin, the latter compound administered *per se* was completely changed to alkaline sulphates. There must therefore be a very fundamental difference between the assimilation of cystin as a substance and the behavior of the sulphur-containing group in the protein molecule. Oxidation of the cystin must occur before the cleavage of the sulphur nucleus from the molecule, else both should behave the same.

The results of Alsberg and Folin are obviously in complete opposition to those of Loewy and Neuberg.

The question now arises as to the difference in intensity of the cystinuria in both these cases and also as to the general relative power of oxidation possessed by the cystinuric and the normal individual. Other cases must be examined.

Some months before the appearance of the paper by Alsberg and Folin we proposed repeating the results of Loewy and Neuberg, using the identical methods employed by the former. Owing to the mode of life of the patient we were unable to carry out our design. For the privilege of examining the urine and for the case report we are indebted to Dr. Herbert S. Carter, to whom our very great thanks are due. The following is the case report:

Mrs. M. N., aged sixty-five years.

Family History. Father and one brother died of cardiac trouble.

Previous History. Always nervous; insomnia for years; has had several sharp attacks of muscular rheumatism; otherwise no illness. Had right breast excised for scirrhous carcinoma fifteen years ago.

Habits. Fair use of wines, particularly champagne, which she takes four to six times a week.

In 1900 had sharp attack of diarrhœa, following which for two to three weeks had two to three fluid stools a day. The urine examined at this time was neutral. Specific gravity 1020; turbid; no albumin; no sugar; cystin crystals in abundance.

Present Illness. Surgical. First specimen was obtained when patient was on regular diet. Second specimen taken two days after removal of left breast for carcinoma same in type as that of right side. Hard, localized. When first specimen was collected had a slight diarrhœa, which cleared up promptly. She is not subject to diarrhœa. When second sample was collected was on light mixed convalescent diet.

Chief Complaints. Exceedingly nervous and occasional attacks of diarrhœa.

Physical Examination. Stout and puffy. Has almost look of myxœdema. Heart is probably a little fatty; sounds faint; action regular. Other organs all apparently normal in size and position.

It was found impossible to put the patient on a uniform diet and to secure regular and complete collection of the urine. Two full

twenty-four-hour specimens were, however, secured at dates twenty-four days apart. The urine was passed into sterile thymolized bottles and was examined immediately for the partition of nitrogen. During the other examinations it was kept on ice, toluol being added to prevent any change.

The following table gives the result of the analyses:

	Specimen I. March 1, 1905. Per diem.	Specimen II. March 24, 1905. Per diem.
Volume	1460 c.c.	1170 c.c.
Specific gravity	1012	1013
Total acidity	395. cc. $\frac{N}{10}$ HCl	269 c.c. $\frac{N}{10}$ HCl
Total nitrogen	8.53 g.	8.20 g.
Urea nitrogen	5.31	5.15
Percentage total	62.0 %	62.6 %
Ammonia nitrogen	1.41	1 60
Percentage total	16.60 %	11.96 %
Amino-acid nitrogen	0.51	0.48
Percentage total	5.95 %	5.93 %
Uric acid nitrogen	0.19	0.095
Percentage total	1.70 %	1.15 %
Kreatinin nitrogen	0.37	0.30
Percentage total	4.35 %	3.66 %
Undetermined nitrogen	0.81	0.57
Percentage total	9.56 %	6.94 %
SULPHUR.		
Total sulphur	0.77	0.63
Neutral sulphur	0.37	0.29
Percentage total	47.70 %	48.10 %
Ethereal sulphur	0.089	0.084
Percentage total	11.80 %	13.50 %
Alkaline sulphur	0.313	0.273
Percentage total	40.50 %	38.40 %
Cystin precipitated by acid	0.458	0.470
Phosphorus as P_2O_5	1.80	0.73
Chlorin	4.29	2.16

Diamins were present in Specimens I. and II. in considerable amount, but not estimated.

The analyses are of interest when compared with those of Alsberg and Folin for the reason that, although in the case of these investigators, diamins were not found in the urine; in our case they were present. The general type of metabolism is, however, strikingly similar. In order to be strictly comparable it is necessary to select a specimen analysis from their series in which the nitrogen elimination was approximately the same. For this purpose we have compared the urine of February 27th.

The only striking dissimilarity is the high amount of ammonia which we found in our samples of urine. For this we are at a loss to account. Alsberg and Folin found that the ammonia was on the whole low, being 3.7 per cent. of the total nitrogen on a similar diet. That the high percentage in both of our specimens was not due to fermentation was made fairly certain by the care with which the urines were collected and the rapidity with which

they were analyzed. On the other hand, the patient was at the time suffering from more or less intestinal disturbance, which does sometimes give rise to high ammonia, as Dr. Folin has privately informed one of us. There is another possibility which may explain the discrepancy.

The method used by us for the determination of ammonia was that of Shaffer,[9] which consists in boiling the urine in vacuo with methyl alcohol and sodium carbonate at 50°. The method which was used by Alsberg and Folin was undoubtedly that described by Folin,[10] which consists in driving air through the urine at room temperature. As our urines contained a larger quantity of diamins than those examined by Alsberg and Folin, it is possible that a quantity of the diamins passed over and were estimated as ammonia. There would not be such a tendency with the method of Folin. It is well known that both putrescin and cadaverin are volatile with water vapor. This was not realized at the time and consequently we have not had an opportunity of examining its correctness. If it were the case the percentage of urea would be increased, as would also be the undetermined nitrogen.

It will be noted that for a nitrogen excretion of 8.5 grams the urea quotient is low, at least 10 to 15 per cent. lower than what one would expect to find in a normal urine. Whether this be due to lessened oxidation or to lessened hydrolysis, as Folin explains the greater part of the urea formation in his theory of protein metabolism,[11] we are unable to say, but the result is one which is noteworthy and agrees with the findings of Alsberg and Folin.

The uric acid and kreatinin do not appear to call for special comment, except that the former appeared to be relatively high compared with the results of Alsberg and Folin, while the latter is approximately the same.

What is, however, very striking is the high amount of undetermined nitrogen. It will be noted that we have elaborated the analyses of the other investigators in determining the amino acids. This was done by precipitating the urine with phosphotungstic-hydrochloric acid, according to a modification of the method of Pfaundler,[12] and making urea and total nitrogen estimations in the filtrate. The value of this estimation has been seriously called into question by several observers, and its clinical significance will be discussed by one of us in a subsequent paper. It is of interest, however, in this particular connection, as it shows that even with this additional factor added there is still a very considerable amount of nitrogen to be accounted for. It will be seen that the amino-acid nitrogen falls within the normal limits given by Satta.[13] Our amount of undetermined nitrogen varies from 7 to 10 per cent. Adding the amino-acid nitrogen to this we have 12.9 to 15.5 per cent. Alsberg and Folin found 9.5 to 27.1 per cent. What this large amount of undetermined nitrogen is due to we are unable to state

definitely, but it is unquestionably made up in great part of the amino acids, the diamino acids or the diamins.

As far as we are aware, no cystin urine has ever been examined for diamino acids, and no statements have been made as to their possible presence there. The recent finding of arginin in the urine in a case of phosphorus poisoning[14] is suggestive.

The Partition of Sulphur.

The chief interest heretofore in cystinuria has been in the partition of sulphur. Less attention has been paid to the forms of excretion of nitrogen. Mester particularly, of the older observers, took the matter up very fully, but his results are really not so complete as the more recent work of Alsberg and Folin.

The results obtained from the foregoing two analyses substantiate the findings of the previous investigators as to the relation which the different forms of sulphur bear to one another. A very large amount of neutral sulphur is formed at the expense of the alkaline sulphates. The ethereal sulphates remain at the same level.

In a preliminary report on the metabolism in brombenzol poisoning,[15] which had for its object the investigation of an experimental cystinuria, we have shown that the process is in this respect analogous. The alkaline sulphates were completely suppressed. The ethereal sulphur rose to 400 per cent. above the normal value. That the process in cystinuria and in brombenzol poisoning is not strictly analogous is shown by the postmortem findings. In brombenzol poisoning the organs are very much altered. Cystinuria is apparently not accompanied by any changes which lead to disturbances other than the cystinuria itself.

The results which have been given above are not sufficient to permit of a discussion of the theories which have been advanced. They are, however, of interest as they show that in a case of cystinuria, in which diamins were found in the urine, the type of metabolism was very like that in the case studied by Alsberg and Folin. It might be mentioned that the cystin in this case on recrystallization consisted exclusively of six-sided plates. We should also like to go on record as stating that a cystin calculus examined by one of us many years ago also consisted exclusively of hexagonal cystin.

We should be glad to hear of any cases in which cystin has been found in the urine, and an opportunity of examining the urine will receive our grateful thanks.

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THE PRESENT STATUS OF BLOOD CRYOSCOPY IN DETERMINING THE FUNCTIONAL ACTIVITY OF THE KIDNEYS.

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During recent years a new method of investigating and estimating the work accomplished by the kidneys has been developed. Koranyi was the first to apply this method to clinical material, and Kümmell soon after formulated definite rules based on a series of cases, which rules were to guide us in determining our operative procedures, and were to give us a deeper insight into the work the kidneys were doing and could do.

Applied to the kidneys this new method consists in the determination of the molecular concentration of the blood by means of freezing it. Normally blood or plasma (human) freezes at —.56° C. If the blood is more or less concentrated, the freezing point will be respectively lower or higher. In other words, if the blood is less concentrated it will freeze before —.56° C. is reached, but if the concentration is increased freezing will not occur till the thermometer has fallen lower. The molecular concentration of the blood varies with the excretion of the molecules which make for this concentration. Fresh molecules take the place of excreted molecules, so that the concentration of the blood is normally maintained at a uniform level.

If the excretion of the molecules were carried out by the kidneys alone we would have an indirect way of studying the work of these organs. As a matter of fact the kidneys appear to be the most important regulators of the concentration of the blood, and we find in general that the freezing point of blood ranges from —.55° C. to

[1] The value of cryoscopic urinary data will not be touched in this paper, as it is generally admitted that such data have little value.

—.57° C., while the kidneys are working normally. When, however, there is disease of the kidneys the proper excretion *may be* hindered and the molecular concentration of the blood is liable to be increased and its freezing point lowered. Experiment, in addition, has shown that between one-half to one-quarter of the normal kidney parenchyma is sufficient to carry on the normal excretion of molecules and to regulate the concentration of the blood.

Kümmell and other enthusiastic supporters of cryoscopy have inverted the above in their application of this principle to clinical work. They say when there is retention of molecules producing increased concentration of the blood, then there exists bilateral kidney disease and a concentration equal to —.60° C. corresponds to severe bilateral kidney disease. If the blood freezes at —.56° C. "there is no general disturbance of renal function which would correspond in the majority of cases to a bilateral kidney disease, *whereas increased concentration regularly denotes a bilateral kidney disease.*"[1]

This is evidently a crude logical error, and those who have arrived at the above conclusions have gone beyond their premises. It is on a par with the following error in logic which few would make: "If an appendix becomes inflamed and ruptures, peritonitis, localized or general, will result; consequently when there is localized or general peritonitis the appendix is at fault and is perforated."

Before we can accept this inversion of the original data, it must be proven that the molecular concentration of the blood is regulated purely and simply by the excretory activity of the kidneys. As we have good reason to think that the kidneys are not the sole regulators of the blood's concentration, nobody has the right to reason as if they were.

It has been repeatedly shown that the freezing points of venous and arterial blood vary by .01° to .02° C.,[2] showing that the pulmonary excretory function also affects the molecular concentration of the blood. In the laboratory test, if free oxygen is admitted to the freezing mixture, this source of error may be almost totally eliminated. Recently, Bendix has shown that the concentration of the blood in kidney disease may be diminished by sweating. Koranyi also has shown that changes in skin secretion may lead to changes in concentration of the blood—*e. g.*, abnormal concentration in the sweating of malaria. Janssen has shown that nephritics sweat less than normal people, so that this will interfere with the concentration of the blood, making at least two factors accountable for the increased concentration of nephritis cases. It is not at all unlikely that liver secretion, and perhaps gastrointestinal excretion and secretion under certain conditions, may also influence the

[1] Kümmell. Langenb. Archiv, 1903, Bd. lxxii. p. 26.

[2] Occasionally the difference is much greater. Koranyi, Zeitschrift f. klin. Med., Bd. xxxiv., has found a difference of .05° C.

molecular concentration of the blood, even though the kidneys be the main regulators. Disturbances in blood and lymph circulation will also affect the concentration of the blood by increasing or diminishing the amount of the fluid part of the blood. Moreover, disturbances in proteid metabolism, anæmias, acetonæmia, as well as the nature of the patient's diet, affect the concentration of the blood and its osmotic pressure.

All these conditions and circumstances may affect the blood's concentration, and that is particularly clearly seen in some cases of anuria. In these cases we have the clearest proof that the kidneys are not the sole regulators of the concentration of the blood. Both Israel and Rovsing have reported cases in which for four days the kidneys stopped secreting, still despite this the concentration of the blood remained a normal one (—.56° C. and —.575° C.). If the kidneys were the sole regulators of the osmotic pressure, then in cases where the kidneys stopped working molecular concentration of the blood would increase. In these two cases such increased concentration did not develop, which can be explained only by assuming that there are other osmoregulatory organs. Moreover, the following diseases, which show marked concentration of the blood with normal kidney activity, also point to the same conclusion. We know that the freezing point of blood may be lowered —that the blood may be more concentrated in a variety of conditions without there being any renal insufficiency. Amongst other conditions the following might be mentioned:

1. Non-compensated endocarditis.
2. Cirrhosis.
3. Epilepsy.
4. Eclampsia.
5. Large abdominal tumors.
6. Acute gout.
7. Prodromal stage of malaria.
8. Terminal stage of malignant tumors.

The fact that the concentration of the blood may be increased in all these conditions without there being a renal insufficiency or renal disease shows very clearly that the kidneys are not the only organs that regulate the molecular concentration of the blood, unless we wish to explain the increased concentration by a functional disturbance of the kidneys without anatomical changes. That is perfectly plausible, though a trifle far-fetched. There is evidence that a normal or almost normal kidney may be functionally disturbed in this way. Such an explanation of the increased concentration in the above conditions puts us more and more at sea. We would have normal organs functionally inadequate, which may obtain. To this we shall recur shortly. This increased concentration of the blood would coincide with severely diseased kidneys, as well as with anatomically normal but functionally

disturbed organs. Even Koranyi[1] has admitted both a reflex and a mechanical renal insufficiency in addition to the insufficiency of renal disease, though the mechanical insufficiency has very little support. Under such circumstances as the above Kümmell's deduction that high concentration means bilateral kidney disease would surely be misleading.

From the foregoing it is evident that there may be anuria with normal concentration of the blood, other organs propably excreting the molecules that can not pass the kidneys. It is also evident that the concentration of the blood may be increased in a variety of other conditions without there being anatomical kidney disease. This increase in concentration we have seen can be explained in several ways. Either the anatomically normal kidney is functionally disturbed or the other excretory organs, etc., are at fault and lead to the molecular retention, or both act together.

Is there any way to decide what causes the increased concentration of the blood in any given case? The answer to this question is still obscure, but in the correct answer lies the verdict of cryoscopy. The above cases of Israel and Rovsing, in which there were four days' anuria with normal concentration, show beyond a doubt that other organs as well as the kidneys are of importance in regulating the concentration of the blood. We can well imagine that a disturbance of the excretory work of these organs might lead to much the same concentration as deficient renal excretion. But in the functionally inadequate, though anatomically normal kidney, we see another possibility for the increased concentration of the blood, and there is considerable evidence that a kidney may be anatomically normal or very nearly normal and still appear functionally gravely diseased. This may show itself not only in affecting molecular retention but also in the diminished amount of urea and fluids excreted.

Kümmell denied the existence of a reflex anuria. His position in the interpretation of cryoscopic data absolutely compelled him to deny such a condition. If he admitted a reflex from a diseased to a healthy or almost healthy kidney, his whole structure would have fallen at his own hands. If we have evidence that disease of one side affects the excretory activity of the other normal or slightly diseased kidney, it will be evident that we are likely to be misled by Kümmell's formulæ. If such a disturbed function can be induced in a second normal or almost normal kidney, the molecular concentration of the blood may be increased and a bilateral serious disease simulated. Now Koranyi has published the case, above all others, which proves that one diseased kidney may affect the excretory power of the second normal or almost normal kidney, it being immaterial, how the process works, whether by means of a nervous reflex or by the action of toxins absorbed from the diseased organ on the

[1] Berliner klinische Wochenschrift, 1901, p. 424.

second non-diseased organ. The concentration of the blood in this case of pyonephrosis was very marked, freezing at —.68° C., indicating serious bilateral disease, according to Kümmell, when really no marked disease was present in the second kidney. In this case, as soon as the pyonephritic kidney was removed, the second kidney's secretion improved, its functional activity became normal, and the molecular concentration of the blood = —.57° C.

Previously, I quoted Koranyi as admitting, in addition to a renal insufficiency caused by disease, a renal insufficiency caused by mechanical conditions and an insufficiency due to reflexes. This case of pyonephrosis, very manifestly, must be grouped with the mechanical or the reflex insufficiencies, as the second kidney was normal. Koranyi himself wished to interpret this case as an instance of mechanical insufficiency without giving any adequate reasons. It is well known that large abdominal tumors often produce a marked molecular concentration of the blood, but since Israel's publication in 1903 it is very clear that the mechanical explanation of this increased concentration is far sought and inadequate. In a word, large tumors are not regularly accompanied by increased concentration, and if the mechanical explanation of renal insufficiency were correct such increase in concentration should regularly follow the development of very large abdominal growths. A much more subtle explanation must be found. In the case in question the diseased kidney affected the well kidney, giving the impression, based on cryoscopic data, that both kidneys were seriously diseased. Rovsing recently stated that he has very frequently seen this functional disturbance of the second organ induced by disease of the other. As soon as the diseased tissue has been removed the second kidney has begun to functionate normally, excreting more actively than before. He says this disturbance of the second kidney is seen most frequently in malignant tumors, less frequently in the following diseases arranged in order of frequency: tuberculous pyonephrosis, nephrolithiasis, uratic nephritis, and perinephritis. Wiebrecht[1] also reports a case of molecular concentration of —.60° C. before operation and after operation —.58° C. Here, according to the formulæ of Kümmell, the diseased kidney, the kidney tumor, would have been removed reluctantly, if at all. Wiebrecht removed it, and as soon as the organ was out the second kidney functioned much better, excreting more fluids and more solids than both organs before the operation. With this increased excretion the molecular concentration of the blood also decreased, as stated above.

It is unnecessary to discuss at this point the whole question of reflex anuria and oliguria. In 1895 Leguen wrote his remarkable paper, which has been so frequently misunderstood and so often

[1] Centralblatt f. Chirurgie, 1900.

misquoted. The author has been made to say that there was no such thing as a reflex anuria, while he never denied the existence of such a reflex. His contention was that in the cases of nephrolithiasis which led to anuria the renorenal reflex had no causative relation to the anuria. On the whole this contention is supported by most later writers, even though a few cases of calculous anuria, due to nervous inhibition of the second normal kidney, are known. Rovsing, Israel, and Kreps[1] have reported undoubted cases of reflex partial or complete inhibition of the function of the second normal or almost normal kidney. The above cases just quoted of Koranyi, Rovsing, and Wiebrecht show the same inhibition, and at the same time show the influence this inhibition has on the molecular concentration of the blood. This increase in the molecular concentration due to functional disturbance is quite sufficient to show how easily one can go astray if one reasons from the degree of molecular concentration to the degree of disease or to the functional capacity. *In other words, a functionally disturbed kidney may lead to marked molecular concentration of the blood, though it be anatomically normal or almost normal, and though in all probability it will prove adequate to carry on its work after removal of the cause of its disturbed function. Unfortunately, therefore, this phenomenon will mislead as readily as that spoken of above, namely, the concentration due to activity or non-activity of the organs, etc., other than the kidneys that have an osmoregulatory influence.*

Before summarizing what has been said, it is well worth while calling attention to the following point so well illustrated by the case reported by Stockmann. In a patient whom he wished to operate upon, but could not because of the patient's early death, the freezing point of the blood was —.56° C. The diseased kidney was to have been removed. Cystoscopy and ureteral catheterization had been unsuccessful. Autopsy showed only one kidney and that riddled with abscesses. In this case the little parenchyma that was left apparently sufficed, together with the other excretory organs, etc., in preventing an accumulation in the blood. One can easily imagine a condition similar to this, as suggested by Rovsing, the patient having two kidneys and both seriously diseased. The one kidney that was the more diseased required a nephrectomy, and, the concentration of the blood being normal, if Kümmell's reasoning were followed, permitted such an operation. Now, if this kidney should contain the greater part of the total functioning renal parenchyma at the disposal of the patient, the latter would suddenly be deprived of this necessary tissue and have an excellent chance to die, despite his normal concentration of the blood. The more diseased organ was doing the greater part of the excretory work similarly to the single kidney in Stockmann's case. The less

[1] St, Petersburger med. Woch., 1903,

actively diseased organ, however, contained less functioning tissue, and suddenly is forced to do more work than it can. Against misinterpretations of such cases ureteral catheterization alone may safeguard us.

Another important point worth mentioning is this: Cryoscopy has been vaunted to the skies, as if we had by means of its data acquired clear insight into the future of our cases. If we exclude all the worst cases and cryoscopic data frequently help us to single out the worst cases, our operative results must improve. Similarly, if an operator refuses all cases of appendicitis with temperature, his records will be excellent. *Cryoscopic data, like quantitative analyses of the urine, tell us in a measure what is happening at the moment and nothing more. The compensatory powers of the kidney are far from the cryoscopist's observational powers, and probably they will never reveal themselves.*

To summarize: 1. The kidneys, though the most important organs in regulating the molecular concentration and osmotic pressure of the blood, are not the only organs, etc., concerned with this intricate process.

2. An anatomically normal or almost normal kidney may be so disturbed in its functional activity as to appear seriously diseased, being temporarily incapable of excreting its quota of molecules.

3. The concentration of the blood may be normal, equal —.56° C., even though the kidneys are functionally inactive and anatomically very badly diseased.

4. The concentration of the blood may be increased to —.60° C. or higher, contraindicating any removal of kidney tissue according to Kümmell, even though the second kidney is anatomically normal but is suffering from a functional disturbance produced by nervous reflexes, or by toxins which come to it through the circulation from the other diseased kidney.

5. The concentration of the blood may be markedly increased, even though both kidneys are in good condition.

6. In bilateral disease, as Rovsing has pointed out, if nephrectomy is done with normal concentration the operator may remove in the diseased organ the majority of the functioning tissue of the kidneys and thus bring on uremia and death, because the renal tissue left in the patient is inadequate for the excretory work.

7. The list of cases that have survived a nephrectomy, despite high molecular concentration, —.60° C., is steadily growing. Many that Kümmell would refuse to operate radically because of excessive molecular concentration probably could be cured by partial or complete nephrectomy.

8. Patients with normal freezing point do not necessarily survive the operation and are not in any way ensured against subsequent uremia.

9. In a large number of cases high concentration corresponds

to bilateral kidney disease, but as yet we are unable to decide which cases of high concentration are not of renal origin, and *vice versa*, which cases of low concentration are suffering or likely to suffer from renal insufficiency. With the solution of this problem future work will have to concern itself.

10. Cryoscopy of the blood, as yet, gives us but little absolutely accurate information as to the present activity of the kidneys; much less, naturally, does it tell us about the outlook, as it is in nowise capable of measuring the compensatory hypertrophy, which may develop in any kidney.

REPORT OF A CASE OF HYPERNEPHROMA.[1]

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On June 6, 1904, I saw, with Dr. Wharton Sinkler, a man, aged forty-four years, who complained of pain in the back, abdomen, and legs. For the past year he had been failing in health and during this time had lost over fifty pounds in weight, but had continued to work in his office until April. There was no tuberculous, malignant, or specific history, nor any recollection upon his part of injury. When I examined him he was complaining of pain in the lumbar region, and there was distinct rigidity of the lumbar spine. There was no abdominal tenderness, but he was extremely ticklish and the slightest manipulation made the abdominal wall rigid. There was no dulness on percussion, as the intestines floated over a growth occupying the whole of the upper, outer quadrant of the abdomen. This was very large, nearly the size of a child's head, and had a distinct outline, particularly on its inner side, and was somewhat movable. It was undoubtedly a tumor of the kidney.

The urine was free from any evidences of disease—there was no albumin, no casts, and no blood, nor was there any history of his ever having passed bloody urine. The urine was being secreted in large quantities with a specific gravity of 1020 to 1224. There were no evidences of bladder irritation, although he arose once at night to pass water; but as the kidneys were acting very freely this might account for this last symptom. He ate well, and after rest in bed his pain gradually diminished, and he was soon weaned entirely from the regular taking of morphine, which, up to this time, had been necessary to give him relief. It was necessary,

[1] Read at the meeting of the College of Physicians, November 1, 1905.

however, while in bed for him to be propped up on several pillows, as he could not lie flat on his back without great discomfort.

His hæmoglobin was 80 per cent., and the red corpuscles 4,500,000.

An *x*-ray examination was negative.

He grew rapidly worse, the pain increased, and the tumor enlarged. After consultation with Dr. J. B. Deaver, Dr. M. Newberry, and Dr. Sinkler an operation was advised, and he therefore entered the Orthopædic Hospital on June 28th. Within the next twenty-four hours he passed 80 ounces of urine with a specific gravity of 1020. It contained no pus, blood, albumin, or sugar, but a few granular casts were found after the urine had been centrifuged for fifteen minutes.

On June 29th I operated by making an incision in the left loin and extending this forward almost to the border of the rectus muscle, and exposed an enormous tumor of the kidney. The capsule was stripped off with some difficulty, the veins being enormously distended, and on account of the size of the growth it was necessary to make a second incision extending up to the border of the ribs. The growth extended well up under the ribs, down into the pelvis, and over toward the middle line. The peritoneum was torn in two places, but they were clamped with forceps and subsequently closed with catgut. It was impossible, owing to the size of the tumor, to get at the ureter and vessels to ligate them, but they were clamped and the kidney and tumor rapidly enucleated and the vessels and ureter cut through and large stout ligatures used to tie the stump of the vessels and ureter in one mass.

There was considerable shock, and a pint of salt solution was introduced into a vein and he was given one-tenth of a grain of strychnine in two doses hypodermically.

There was comparatively little hemorrhage for such a grave operation, as all bleeding parts were secured by ligatures. Two long pieces of sterilized gauze were packed lightly in the wound, and it was then partly closed with through-and-through silkworm-gut sutures.

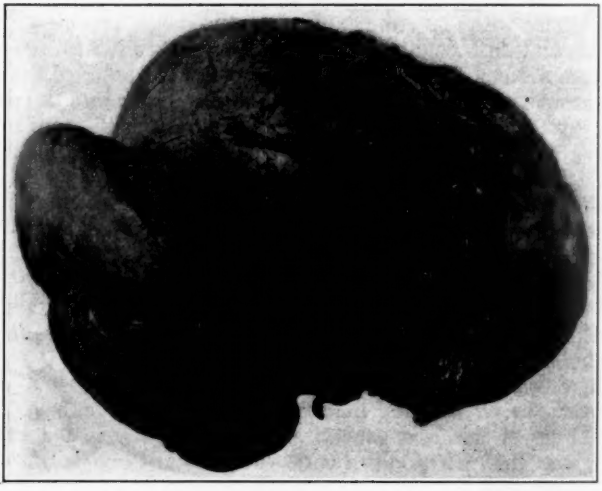
He reacted very nicely from the operation, and did not vomit. It was not necessary to change the dressing for about eight hours, when it was pretty thoroughly soaked with bloody serum, but he had to be given much more morphine than would have seemed wise under ordinary circumstances. By the next day he began to take some peptonized milk, drank freely of water, and the kidney acted well, as in twenty-four hours there was twenty-four ounces of urine withdrawn by catheter.

The tumor when it was removed weighed 6½ pounds, was 10 inches long in its longest diameter, 7 inches across, and 5 inches thick. It was sent to Dr. W. T. Longcope, of the Pennsylvania Hospital, for examination, who reported it to be a hypernephroma, and gave this detailed report:

The specimen has been preserved in formalin.

It consists of a huge, irregularly lobulated mass somewhat oval in shape and measures 20 cm. in its longest diameter. It weighs 2150 grams. The surface, although quite irregularly lobulated and at one extremity covered with adhesions, is rather smooth and the mass appears to be encapsulated. At one end the remains of a kidney can be seen. The two poles are well preserved and the surface appears granular. From pole to pole the kidney measures 14.5 cm. The tumor seems to arise from the central portion of the organ. It involves almost the entire dorsum, an area about 6 cm. in length on one lateral surface, and the entire portion of the other lateral surface, from which it bulges out considerably. On

FIG. 1



Hypernephroma, showing the relation of the tumor to the kidney. Weight, 6½ pounds.

this side the growth extends directly into the pelvis, which is bulged, and measures about 5.5 cm. in length. On section the position and nature of the growth become clearer. Springing from the hilum of the kidney there is a large growth. At the sides the kidney substance, showing practically normal markings, surrounds the growth, thinning out into a narrow capsule as the tumor widens. The tumor is apparently everywhere surrounded by a capsule. The central portion is made up of blood clot with here and there bright-yellow pigment. About the extreme margin and at the pole opposite to the kidney the growth appears to have some structure. It is made up of irregular spaces filled with what looks

like innumerable minute papillomatous processes tightly squeezed together. The color is white.

Occasionally these spaces appear to be degenerated and partially filled with blood. They were always best preserved about the periphery. Sections were made from parts of the tumor mass.

The tissue is not well preserved and the cells are much shrunken.

Kidney. There is a fairly well-marked and diffuse increase of connective tissue throughout the cortex. In these situations there are many small round cells and the tubules show atrophic change. Hyaline casts are quite numerous. The convoluted tubules are large. The epithelium is granular but usually very much shrunken. One or two of the tubules contains large, irregular cells filled with brown pigment. The glomeruli are slightly injected. A few show thickened capsules.

Section from Tumor. Sections from all portions of the cortex show the same structure. Toward the central portion part of the tissue becomes necrotic.

Sections from the central red mass are composed of necrotic material, blood, and brilliant orange-colored pigment in amorphous granules or small spicules. In all sections made through the periphery the tumor is surrounded by a connective-tissue capsule of unequal thickness. It shows very few cells. The growth is arranged as masses of cells of unequal size, separated by connective-tissue trabeculæ carrying bloodvessels. From these coarse, fibrous trabeculæ delicate strands of connective tissue and bloodvessels run throughout the compact masses of tumor cells. The growth is composed of large, irregular polygonal cells closely packed together. The protoplasm shows extreme vacuolization, so that frequently it is only possible to make out a limiting cell membrane and a nucleus placed usually in the centre of the cell. The nucleus is comparatively small and round and stains deeply in hæmatoxylin.

Karyokinetic figures are not observed. These cells resemble very closely the cortical cells of the adrenal. In some sections the connective-tissue trabeculæ contain orange-colored pigment. Near the kidney the capsule of the growth is composed of kidney tissue. The capsule here is made up principally of connective tissue, but a few glomeruli and compressed tubules are seen in places.

Diagnosis. Hypernephroma of kidney.

He reacted very well from the operation, and on July 2d his temperature was only 99° and his pulse 100. An attempt was made to remove the packing, but as it gave him great pain he was given chloroform and the packing was then readily taken out. There was no hemorrhage, and a small piece of iodoform gauze was put into the wound for drainage. The bowels were opened freely, as the result of calomel, and he took peptonized milk with relish. By July 17th the wound was so well closed that he was lifted out of bed into a wheeling chair and taken out on the roof in the cool of

the afternoon, and on that day he ate well and slept well, and passed forty-seven ounces of urine.

On August 14th he was taken to his home in the country in remarkably good physical condition.

By September 6th he had gained very much in strength, in weight, and in color. There was some pain in the region of the wound, there was no swelling, but it was somewhat tender on pressure, and this only on motion of the body and after he had been sitting up for some time. It was thought that this might be due to a neuritis of the ilioinguinal nerve, which had been damaged during the operation, and particularly as there was an area of numbness over the anterior superior spine of the ilium. Under full doses of iodide of potassium, ice to the side, and quiet in bed for a week, the symptoms were very much relieved.

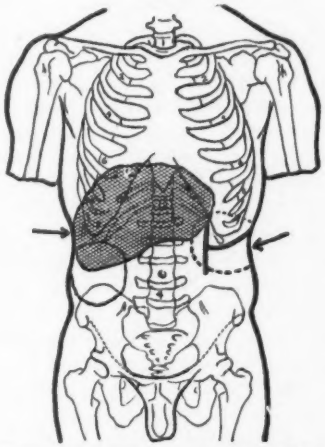
The pain in the back returned and by October 25th was also on the right side. He had been taking about one grain of morphine hypodermically per day and it was therefore difficult to say whether his desire for morphine did not exaggerate his pain. His color was not good; he had lost flesh in the last two weeks; but his appetite was fair; while his nights were restless and sleep only obtained by the use of morphine. The urine was highly colored, but the quantity fair in amount. He had had no rise of temperature for a long time, but on October 24th, for the first time, he vomited mucus which was dark-stained, probably bloody, amounting to about a tablespoonful.

By November 3d he had continued to lose flesh, his color was very poor and he had almost continuous pain. This pain was in the back and loin and particularly marked on the right side in the region of the remaining kidney. He was so sensitive to manipulation that the slightest touch to the parts produced a muscular spasm, and for this reason it was difficult to make a satisfactory examination. There was, however, a distinct increased area of dulness over the region of the kidney and in the right hypochondrium, with a sense of resistance and probably a mass in that region. From the conditions it was suspected that metastasis had occurred and that there was a growth in this kidney and liver. There was persistent and increasing pain with progressive loss of flesh in spite of a very good appetite and every effort to induce an increase in weight. There were diminished knee-jerks, and he complained of numbness in the legs and thighs and he seemed to be uncertain in his gait.

By December 16th he was much worse. There was swelling and extreme dulness over all the whole right side of the abdomen, extending almost from the umbilicus to the flank and from the border of the ribs to the iliac fossa. His pain in the past few days had become less and he had been able to go a whole day without morphine. There had been very marked swelling of the feet and limbs; but this also had subsided within the past few days. Evi-

dently there had been a relief from pressure upon certain of the bloodvessels by change in the size or position of the growth. The bowels were obstinately constipated, so much so that it was difficult for him to have a stool of any sort even with a high rectal enemata and active purgatives given by the mouth. This was much more marked than can be accounted for by the hypodermic use of morphine. He was thin, his color very poor, and he complained of a picking sensation all over his body, and the lower limbs were bluish. He was passing a fair quantity of urine, which showed no evidence of blood, although a careful microscopic examination was not made at this time. He was so weak that he was unable to leave his bed, and while his appetite was still fair and he was able to take a good amount of nourishment, the disease was evidently progressing rapidly.

FIG. 2



(1) area from which the tumor was removed, June 29, 1904, and (2) of dulness December 20, 1905, and (3) enlargement of right kidney.

On December 20th he was seen for the last time. The disease had been making rapid progress. He was greatly emaciated, but his tongue was clean and his appetite good. There was marked constipation and the stools were extremely dry. Physical examination showed a fulness and distension of the whole of the right side of the abdomen, extending over to the left of the middle line, even beyond the line of the nipple. There was a large area of dulness and induration, which was undoubtedly a very great enlargement of the liver, particularly of the left lobe. Fig. 2 shows about the area of dulness. The edges of the liver seemed to have been generally thickened, and it was thought the

right kidney was implicated in the growth; the kidney, liver, and stomach, or at least the pyloric end of the stomach, all seemed involved in this new mass and were probably welded together with adhesions. Shortly after this he had marked swelling of both legs. Certain of the superficial veins of the abdomen were very much dilated and it showed conclusively that there had been a collateral circulation established to provide against the stoppage of veins internally compressed by this growth. He had at times vomited blood-stained mucus and undigested food, and the nurse stated that whenever a hypodermic of morphine was given, and he took about three grains of morphine a day, the prick of the needle bled freely—so freely that she had to make pressure upon the skin for some minutes to stop the bleeding. There was also some fulness in the region of the old wound posteriorly, but the whole of the abdominal scar was in good condition.

He lived until January 19, 1905, suffering pain until his death, just a little over six months from the date of operation, and about a year and a half from the appearance of his first symptom.

No postmortem examination was permitted.

I desire to place on record the history of this case of hypernephroma, which is, from a pathological standpoint, typical in its microscopic findings but which lacks one very important symptom usually associated with this condition—*i. e.*, hæmaturia. So much has been written on this subject of late by various authors, that I shall not go into any elaborate description of the disease, but merely call attention to the chapter on tumors originating in the suprarenal gland, by Morris (*Surgical Diseases of the Kidney and Ureter*, vol. ii. p. 15), and to the admirable paper read at the meeting of this College in November last by Drs. Keen, Pfahler, and A. G. Ellis, in which two cases are reported with an analysis of twenty-six reported cases. They give as the three important symptoms hæmaturia, renal colic, and the detection of a tumor. Why some cases should be intensely malignant with rapid recurrence, involving other organs both adjacent and remote from direct contact with the original seat of the disease, has not yet been explained by the pathologist; and, indeed, in the examinations they seem to be unable to distinguish the malignant from the non-malignant cases. Dr. A. O. J. Kelly, in his studies, urges most strongly that the bloodvessels be cut off as soon as possible and that the manipulation of the tumor be exceedingly gentle that metastasis may be prevented, and this would seem a wise precaution.

The absence of hæmaturia in this case I report to-night is very strange, as the kidney itself was so deeply involved in the new-growth that one would have supposed this symptom would have played a prominent part.

Albarran found that hæmaturia occurred in 75 per cent. of the cases in his tables, and in Dr. Pfahler's twenty-six cases it was

present in 19 per cent. Dr. James Bell, of Montreal, in a discussion upon a case of hypernephroma (*Montreal Medical Journal*, July, 1905), presented by Dr. Shepherd, stated that the symptoms of hemorrhage means beginning degeneracy or malignancy, and that during the premalignant stage there is not likely to be hemorrhage.

In the one here reported, proved to be intensely malignant, with marked involvement and destruction of the kidney structure, there was never any blood in the urine.

A CASE OF DOUBLE PYONEPHROSIS, WITH AUTOPSY REPORT.

By M. Krotoszyner, M.D.,
San Francisco, Cal.

The diagnosis of diseases of the urinary tract is made much more accurate of late, especially since the cystoscope has sent its illuminating rays into the interior of the bladder. Inspection of the ureteral orifices and their surrounding tissue and careful observation of the fluid emanating from either opening permits of valuable diagnostic conclusions upon the condition of either kidney. Wherever we can obtain renal secretion separately by ureteral catheterization, we can by subjecting both samples of urine to physical, chemical, and microscopic tests arrive at a reasonable diagnosis as regards the functional and anatomical value of either organ and no surgeon needs to-day to cut down on one kidney without having ascertained the functional capacity of the other organ beforehand.

Only a year ago I stated in another publication[1] that almost every bladder could with patience, perseverance, and the necessary skill be cleared up to such a degree as to permit cystoscopic inspection and catheterization of either ureter. The success in accomplishing this in a few exceptionally difficult cases prompted me to boast that every bladder would in proper hands and in due time yield to efforts at ureteral catheterization. The case, though, that is the subject of this communication, does not substantiate this statement. All efforts at inspection and catheterization of the ureters through cystoscopy failed. Diagnosis and surgical interference had to be made without this aid. This case is a vivid illustration of the diagnostic importance of the cystoscopical method in permitting the recognition and the correct interpretation of dark renal lesions. Nothing will prove this better than a brief narration of the more important features of this singular observation.

The patient, a clerk in the police department, aged thirty-nine years, was referred to me by Dr. Henry Harris on February 9, 1905.

[1] The American Journal of the Medical Sciences, May, 1904.

Family and previous history unimportant. The patient had enjoyed good health until fourteen months ago, when he was thrown from a buggy, falling on his left side. Had severe pain on that side and noticed hæmaturia three days after the accident, which persisted only a few days. All symptoms incidental to the accident disappeared gradually and the patient was comparatively well during the next six months save for occasional attacks of pain in his left side and frequent and painful micturition of cloudy urine. Six months after the accident he began again to pass bloody urine (clots) and at the same time was stricken with a severe bronchitis which confined him to his bed for over two months. During this period and even for a short time after getting up from bed hæmaturia persisted. Although blood disappeared from his urine, the patient, nevertheless, began to suffer from constant painful and frequent micturition; urine was cloudy and contained much pus, the amount of pus steadily increasing in quantity. About three months ago spells of nausea, vomiting, chilly sensations, and sometimes sweats set in. Has lost weight of late. At times urinary incontinence.

Patient has the appearance of a robust man with good physique and has performed his duties as a police clerk until the first day of examination.

As Dr. Harris had made repeated careful examinations of heart, lungs, etc., with negative results as to pathological findings the examination was at once directed toward the urinary tract.

Palpation of both kidney regions revealed nothing of pathognomonic note. Deep and persistent bimanual palpation of either kidney did not elicit any painful sensation except a sensitive spot extending over an area of two inches above the bladder on the left side. Prostate normal in size, sensitive to touch; ureters not palpable per rectum; inguinal glands not perceptibly enlarged. A soft rubber catheter was introduced into the bladder and about 60 c.c. of a yellow-reddish and purulent fluid obtained, which on examination showed a considerable amount of albumin; no sugar; microscopically pus and red cells, numerous bacteria, no tubercle bacilli. Sample of urine sent to the pathologist, Dr. Ophuls, with the request to inoculate a guinea-pig. At the same time cystoscopy was attempted, but no picture of the bladder wall could be obtained on account of impossibility to fill the bladder with clear fluid. In view of the presence of marked uræmic and septic symptoms (nausea, vomiting, dizziness, headache, fever, scanty urine, etc.) the patient was persuaded to enter Mount Zion Hospital on the following day.

Here these symptoms gradually disappeared in a few days after bed rest, careful diet, and proper medication, so that on February 14th a second attempt at cystoscopy under local anæsthesia could be made which again for reasons above mentioned was unsuccessful. During the next few days attempts were made to prepare the

bladder for cystoscopy by daily lavages, stress being laid upon increasing the bladder capacity. During these days the patient passed daily between thirty and forty ounces of a cloudy purulent urine of a low specific gravity with a fair amount of urea (20 to 30 gr.). The blood showed 14,000 leukocytes; pulse ranged between 70 and 120, temperature between 95.5° and 102.5°, respiration between 18 and 24, symptoms of sepsis and slight uræmic disturbances increased (drowsiness, nausea, occasional vomiting, feeling of extreme weakness, etc.). Therefore on February 16th a third attempt at cystoscopy was made, this time under spinal anæsthesia (0.06 tropacocaine). A good view of the bladder wall was obtained, which was found to be covered with ulcerations and showed numerous diverticles of various size. Careful and repeated inspection of both ureteral regions did not show any slit or opening suggestive of either ureter; the bladder though became clouded so rapidly that the few attempts made to strike by chance the left ureter through any of the many diverticles visible in this region were futile.

The patient was at this time over ten days under our observation and no progress had been made as regards the diagnosis, while his condition certainly grew worse and demanded quick and energetic action. Here we had a patient whose symptoms pointed to an affection of his kidneys, preferably the left side, as indicated by the history. No answer though could be given to the questions: Is only one or both kidneys affected? If one kidney is at fault, is the other functionating sufficiently to warrant removal of one organ? Which side, if any, should be attacked first? True, the daily quantity of urine and of urea excretion was satisfactory, but which kidney was responsible for its excretion? Could not the left kidney, though containing pyonephrotic foci, possess the bulk of functionating tissue, while the other side was functionally so inferior that nephrectomy on the left side would be followed by a fatal outcome?

In order to clear up these mooted points it was decided to make one more attempt at cystoscopy under spinal anæsthesia. If again ureteral catheterization should fail, the left kidney should be exposed at the same sitting, for the reason that the beginning of the patient's urinary disturbances pointed to the left side and that he exhibited a sensitive spot on the left side above the bladder.

February 21st, 0.06 tropacocaine by spinal puncture, cystoscopy reveals a clear picture of bladder wall equal to that described above, purulent grayish matter was seen to spurt from a point corresponding to the right side of trigone. Inspection of left side of sphincter reveals nothing to aid the diagnosis. Several attempts at catheterization futile. Therefore, the left kidney was quickly exposed and found to represent a fluctuating sac, which was with difficulty freed from adhesions and brought to the surface. Incision permitted the escape of a large quantity of green pus; hardly any kidney sub-

stance could be seen macroscopically and therefore the sac was removed in toto after ligating the pedicle *en masse*.

The patient rallied well from the operative shock and urinated thirty-five ounces of urine the first twenty-four hours. During the first three days after the operation his temperature did not rise above 99°, while his pulse rate increased to 120. Constant vomiting and hiccough set in, which could not be controlled, symptoms of uræmia and sepsis increased (headache, restlessness, finally coma), heart action and respiration became very rapid and the patient died on the evening of February 26th, five days after the operation.

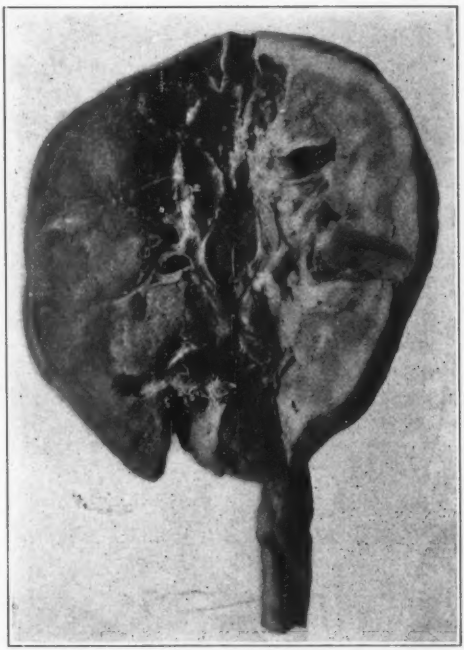
FIG. 1

The autopsy had to be confined to the urinary tract and was performed by Dr. A. L. Fisher, to whom I am indebted for the following report:

Left kidney (Fig. 1) is converted into a number (nine) of cysts, the largest of which is about 5 cm. in diameter and the walls of which are mainly of fibrous tissue. At the time of the operation these cysts contained a small amount of turbid urine. Very little of kidney substance is left. Along the convexity of the kidney one sees several yellowish slightly elevated spots about the size of a pin's head, which microscopically prove to be tubercles. The little that

remains of the kidney substance shows the microscopic evidences of a chronic parenchymatous nephritis. The cysts communicate with one another, and at the hilus a small opening, probably representing the lumen of the ureter, is noticeable. The cyst walls are slightly trabeculated and show deposits of a yellowish and rather cheesy material. A culture taken from the cyst contents was sterile, and, on microscopic examination, neither tubercle bacilli nor the ordinary pus producers could be found.

FIG. 2

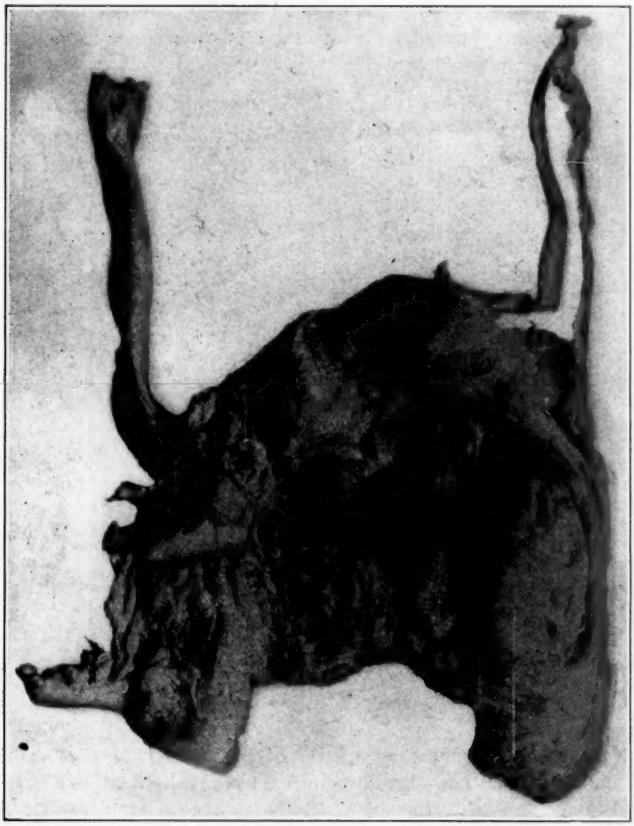


Right kidney (Fig. 2) is large, measuring 13–9–5 cm. and of a rather soft consistency. The capsule is slipped off without difficulty, leaving a fairly smooth surface of mottled appearance and showing here and there several yellowish spots projecting above the surface. On sections the kidney substance is mottled, showing several irregular cavities from which pus exudes. The cortex is wider than normal, averaging 7 cm. The markings of the kidney are somewhat obscured and distorted. The Malpighian bodies are visible. Microscopic examination reveals the picture of a parenchymatous nephritis and shows in some places suppurative foci.

Right ureter and bladder (Fig. 3) taken out with right kidney. The ureter is greatly distended, measuring 2 cm. in circumference. Its walls are thickened and intensely injected and its lumen filled with turbid fluid.

The bladder walls are thickened and friable, in one place in the region of the left ureteral opening the bladder wall was torn into

FIG. 3



in removing it. The inner surface of the bladder is trabeculated and shows many diverticula of varying size and depth. The mucous membrane is injected especially about the trigone.

The left ureter was not found. Unfortunately no cultures were taken from the right kidney.

Dr. Ophuls' report upon the result of inoculation was as follows: Guinea-pig inoculated intraperitonally February 13th, examined

March 13th. Tuberculosis of peritoneum, spleen, liver, diaphragm; few tubercles in lung; few tubercle bacilli found in cover-slips from spleen.

We have to deal in this case with a mixed infection. Etiologically the patient's fall upon his left side caused in all probability an acute pyelitis and periureteritis. By the inflammatory condition of the ureteral wall the flow of secretion from the kidney was impeded. Through a lessened contractibility and elasticity of the ureteral wall stasis and congestion in the kidney occurred, which again gave the impetus and prepared the fertile soil for infection.

Infection of the bladder took place from above. The very frequent and painful micturition and its accompanying spasms of the sphincter caused an intense intravesical increase of pressure through which infected urine was forced back into the right ureter. Hence ureteritis, pyelitis, and pyonephrotic foci on the right side.

The long duration of the inflammatory process favored the establishment of tuberculous foci in the left kidney, the bladder, and by ascending infection in the right upper urinary tract. The left ureter was probably obliterated a long time before the patient came under observation.

Inspection, percussion, and palpation did not give aid to the diagnosis in the least, neither could we have hoped to gain much by Roentgography. Even cystoscopy could not further the diagnosis materially. As the trigone was distorted and contained many diverticles and ulcerations, results obtained with a urinary segregator would have been unreliable. The only method of real value would have been ureteral catheterization. If the right ureter could have been catheterized and renal secretion from that side obtained for inspection and examination it would have told us all important data upon the anatomical and functional condition of the right kidney. As exposure of the left side had revealed an absolutely valueless organ, a nephrotomy could have been performed at the same sitting on the right side and it is possible if not probable that thorough drainage of that side would have saved the patient's life.

ABSCESS OF THE BRAIN, WITH A REPORT OF FIVE CASES.

By Henry Farnum Stoll, M.D.,

ASSISTANT ATTENDING PHYSICIAN TO THE HARTFORD HOSPITAL AND THE WILDWOOD FARM SANITARIUM; PHYSICIAN TO THE CLINIC FOR PULMONARY TUBERCULOSIS, HARTFORD DISPENSARY, HARTFORD, CONN.

During the two years the writer was on the resident staff of the Hartford Hospital five cases of cerebral abscess were admitted, in

[1] Read before the Hartford Medical Society, June 19, 1905.

which the diagnosis was confirmed either by operation or at the autopsy. Through the courtesy of the several attending physicians and surgeons he is permitted to report them somewhat in detail.

CASE I.—George P., aged ten years; a school-boy and a native of Connecticut, was admitted on May 16, 1903, to the medical ward of the hospital under the service of Dr. F. T. Simpson.

Family History. Negative except that two cousins had chorea.

Personal History. He has had no illness until the present one. Two weeks ago (May 2d) some of his playmates observed that he fell from his bicycle, striking his head against a tree. The injury was so slight that he did not inform his parents of the accident. Ten days ago (May 6th) he complained of a severe headache, rather general in character, and of numbness in his left hand. One week later—that is, three days before admission to the hospital —he had another headache and on two occasions twitchings were observed of the left side of the face and of the left hand. They were not accompanied by loss of consciousness and their duration varied from five to ten minutes. The day following he had three similar attacks, during one of which he vomited and in another he was observed to froth at the mouth.

Physical Examination. The patient walked into the hospital. He is fairly well nourished and does not appear to be acutely ill. Examination of his head fails to reveal any evidence of ancient or recent injury. The pupils are equal and react to light and accommodation. The tongue is moderately coated and protrudes in a straight line. Heart, lungs, and abdomen negative. The grip of both hands is equal; the skin of the left one is slightly cyanotic.

The amount of urine passed was small, and contained a trace of albumin and a few hyaline and granular casts.

May 18th. He vomited after calomel and again later after salts. In the afternoon he had a convulsion lasting about five minutes. It began with a twitching of the left side of the face and the left angle of the mouth, slowly extending to the superficial muscles of the left side of the neck, the jaws being partly closed and the lower one drawn to the left. In about two minutes after the onset the index and middle fingers of the left hand began to twitch. During the attack the patient was much frightened and cried out, but did not become unconscious. At this time the tongue protruded toward the left. No changes in the eyes were noted.

His condition remained about the same for the next four days. He vomited occasionally and complained of pain in the right side of his head, which at times was severe. Part of the time he would sit up in bed and play with toys. He did not appear to be particularly sick. By the 24th, one week after admission, he had become somewhat drowsy, but would rouse up when spoken to. The day following the stupor was more marked, and early on the morning of the 26th he had a sudden severe tonic convulsion, which involved

both arms and was accompanied by unconsciousness. Its duration was about one-half hour and was not followed by paralysis. A few hours later he had another convulsion, which involved both arms and legs. His leukocytes were 20,000.

It was decided in the morning to operate that afternoon, but he died about noon. At the autopsy no fracture of the skull was found. The meninges were much congested, and an abscess the size of an English walnut was discovered in the right half of the cerebrum, encroaching on the Rolandic fissure. It had a firm capsule.

Albert, Osler, and Phelps state that trauma causes more abscesses of the brain than otitis media, while Gowers, Bramwell, Treves, Oppenheim, and MacEwen place the latter cause first. Starr maintains that trauma causes 50 per cent. of the cases. When an abscess is of traumatic origin it generally occurs at the site of injury; rarely at the point of *contré coup*. This case has a medicolegal interest, in that a blow on the head, which neither fractures the skull nor lacerates the scalp, can cause a cerebral abscess; and secondly, that a capsule can be formed in less than one month. Moreover, this case demonstrates that when an operation for cerebral abscess is decided upon it should be done *at once*. MacEwen reports a case where the operation was postponed for three hours, during which time the patient died from rupture into the lateral ventricle.[1]

Case II.—Charles B., aged thirty-three years; single, and a bricklayer by occupation; was admitted to the medical wards of the hospital under the service of Dr. William Porter, Jr., on May 12, 1904.

Family History. Father died in 1889 of tuberculosis, and a brother died with the same disease in 1892. Patient was with each one during his illness.

Past History. Drinks three to five glasses of beer a day, but not to excess. Has never had syphilis but had gonorrhœa six years ago. Prior to eleven months ago he had never been sick. At that time he developed a cough, which has continued ever since. The expectoration has been profuse in amount; mucopurulent in character, of very foul odor, and often blood-streaked. He has never expectorated pure blood. For the past year he has had night sweats. Has had no dyspnœa. At times there has been a slight pain extending through the upper part of the right lung. He has lost no flesh, although he has lost strength and easily becomes exhausted. For this reason he has not worked for nearly a year. He has never been subject to headaches. During the past few months his family have noticed no change in his disposition.

Present Illness. Last night upon retiring the patient seemed as usual, but about 4 A.M. his brother was awakened by his heavy breathing. Soon he got up and began dressing, saying he was going home. He walked about the apartment for a short time, talking

in a rambling sort of way, and suddenly he had a severe convulsion involving the whole body. During it he was unconscious and bit his tongue.

When consciousness was regained he seemed rather dazed but sat down to breakfast with the family. While at the table he had another convulsion similar to the preceding one, during which his face was cyanosed and his eyes were turned to the *left*.

Physical Examination. Patient was brought into the hospital in a state of wild delirium and put in a straight jacket. He talked incoherently for a time, then went to sleep.

He is a man of very large frame and excellent muscular development. Both pupils are contracted but react slowly to light and accommodation. Tongue slightly coated, protrudes in a straight line. Breath is offensive.

Heart. Sounds are faint; otherwise negative.

Lungs. Over right apex, both anteriorly and posteriorly, there are dulness, diminished breath sounds, and increased voice conduction. A few subcrepitant rales are heard below the right clavicle (inner third) and opposite the spine of the right scapula; otherwise the lungs were negative.

When consciousness returned he remembered nothing that had occurred that morning. He complained of frontal headache. The leukocytes were 9200; urine, 1015; acid, trace of albumin, and a few hyaline casts.

13*th*. He has no headache to-day and his mental condition appears normal.

14*th*. Feels perfectly well and refuses to remain longer in the hospital. He was discharged at his own request. That night and the following morning he was at home and seemed about as usual. In the afternoon of the 15th he had a convulsion and was brought to the hospital. He was violently delirious and before he could be put to bed he had a convulsion. It involved the whole body, and during it the face was very cyanotic and his eyes were turned to the *right*. Its duration was about five minutes and it was followed by several hours of sound sleep.

The next morning he was rational, remembered none of the events of the preceding day, and complained only of slight headache. He was with difficulty persuaded to remain in the hospital. The headache had disappeared by the 18th and never returned. Some of the time he would sit up in bed and read, at other times he would endeavor to get out of bed, not seeming to realize what he was doing.

20*th*. Leukocytes were 7800. The sputum was very fetid, profuse in amount, containing streptococci and diplococci, but no tubercle bacilli. He answers questions rationally but deliberates a long time before doing so.

24*th*. Periods of apathy alternate with those of mild delirium. Athetoid movements of both arms and hands are noted. He

expectorates on the floor constantly, and, when reprimanded, immediately repeated the offence in a dazed way. By the 26th he had become much disoriented. The leukocytes were 7500. The drowsiness continued until the morning of the 28th, when he suddenly had a severe convulsion, which lasted twenty minutes and terminated in death.

At the autopsy the dura was found to be normal. The pia was thickened over the left frontal lobe and over the Rolandic fissure. In the middle convolution of the left frontal lobe was an abscess 5 cm. by 3 cm. in size, which was surrounded by a thick capsule, whose inner surface was green in color. The pus was very fetid and had the same odor that his sputum had during life. Cultures made from the pus were sterile.

There was an encapsulated cheesy mass 1½ cm. in size just above the abscess and very near the cortex. There was no communication between this mass and the abscess. Sections of the mass were examined for tubercle bacilli, but no organisms were found.

Lungs. The left one was normal. The right one was adherent throughout and just below the apex was a cavity about 2½ cm. in diameter.

Metastatic abscesses are rare and usually multiple. The suppurative focus may be in any distant part of the body, but those resulting from a purulent condition of the bronchi or other pulmonic tissues are most common. In 58 such cases collected by Claytor in 1901, 20 were due to bronchiectasis and 10 to empyema.[2]

A large variety of organisms has been found and Blöttche demonstrated pulmonary pigment in the pus; very rarely they are sterile. The metastasis occurs by way of the artery to the fossa of Sylvius.

As the frontal lobe is one of the "silent areas," an abscess can exist there for an indefinite period, causing no symptoms, providing it neither increases in size nor extends to the surrounding brain substance. When the increase in size is very slow it simulates a brain tumor. A complete change in disposition and temperament has been observed with abscesses of the frontal lobe. Such a change, it will be recalled, occurred in the celebrated crowbar case.

The absence of a leukocytosis was probably due to the complete encapsulation of the pus; possibly to the absence of pyogenic organisms.

The *Lyon Medical*, July 17, 1904, reports a case remarkably like this one; even to the similarity in odor between the cerebral pus and the sputum.

CASE III.—Annie P., aged twenty-four years, was admitted on December 3, 1903, to the surgical wards of the hospital under the service of Dr. A. G. Cook.

Family History. Negative.

Past History. She had scarlatina when a child, but ear involvement is not known. There has never been an otorrhœa until present illness and she has always enjoyed good health.

Present Illness. Two weeks ago the patient attended an evening gymnasium class, and upon returning home took a bath before retiring. She was awakened during the night by pain in her left ear. The next morning, as the pain continued, she consulted her physician, who douched the ear. On the day following, as the pain was still severe, she was seen by an ear specialist, who told her she had an abscess in the ear. He incised the drum and there was a discharge of pus for a few days. Up to four days ago the pain had been confined to the ear. On that day (November 30th) she also complained of pain just above and anterior to the left ear. For the two days prior to admission the pain has been referred to the base of the brain. Yesterday she was somewhat delirious, but to-day she has been drowsy. There have been no chills, twitchings, convulsions, or vomiting. Axes of eyes have been normal. Yesterday and the day before her temperature was 104°. No aphasia has been observed. Athetoid movements, more marked in right hand and arm, have been noted during the last few days. The patient has had retention of urine.

Physical Examination. The patient was carried into the hospital. Is very drowsy. She is well nourished and prematurely gray. Pupils are equal. Slight twitching of left upper eyelid. No discharge from the ear. Heart, lungs, and abdomen negative. Leukocytes, 20,000. The urine contained a trace of albumin and granular casts.

Immediate operation being decided upon, Dr. Cook trephined three-quarters of an inch above external auditory meatus, but search in all directions did not reveal pus. The condition of the patient becoming alarming, the operation was not prolonged. She failed steadily and died the next night.

At the autopsy the brain was found of normal consistency. At the site of operation were many blood clots. Pus was present between the pia and the brain over the lower outer aspect of the right frontal lobe and over the upper and nasal aspect of the left frontal lobe. On section the brain was normal in appearance except for an area of softening, filled with disintegrated brain tissue, pus and blood in the left parietal lobe just posterior to the Rolandic fissure. There was no capsule and the abscess cavity communicated with the left lateral ventricle. Smears from the pus showed cocci, some of which were in chains.

CASE IV.—Alex. N., aged twenty years, a machinist and a native of Sweden, was admitted January 19, 1903, to the surgical wards under the service of Dr. E. J. McKnight.

Family History. Negative.

Personal History. When a child he had a discharge from his right ear, the etiology of which is not known. The otorrhœa has been more or less constant ever since. For some years, the exact number not known, the patient has had occasional attacks of sudden

vomiting, associated with pain in his right ear. They would be of a few hours' duration and on the following day he would be all right.

Two months ago the discharge from the ear ceased and did not return.

Present Illness. Ten days ago he complained of earache, which has persisted, increasing in severity and extending over the mastoid region. He has complained of vertigo at times, but has had no convulsions nor chills. Three days ago he became drowsy, this giving place yesterday to delirium. The bowels have been constipated throughout.

Physical Examination. The patient, a large man who looks very ill, was carried in the hospital. He appears drowsy. Heart, lungs, and abdomen negative.

The drum of the right ear was found to be bulging, and Dr. Craig did a paracentesis, obtaining only a small amount of pus. The urine was 1026, acid, contained a trace of albumin, no sugar, no casts.

Shortly after admission he vomited. The next day he was delirious part of the time, and vomited several times.

On the 22d, three days after admission, he had two convulsions, which involved the whole body. It was observed that the pupils were unequal and the leukocytes were found to be 22,400. Dr. McKnight trephined over the temporosphenoidal lobe and a large abscess was evacuated. The cavity was irrigated and drained.

The patient died seven hours afterward and a postmortem was refused. Owing to a number of years' residence in this country he spoke English fluently. One morning shortly before his death, while making his rounds in the hospital, one of the doctors asked him how he felt. It was evident he did not understand the question, for turning to his brother, who was by his bedside, he said in Swedish, "I can't understand what they say; ask them to speak Swedish." Subsequently, until the end, his mother tongue was the only one he understood.

Case V.—James G., aged twenty-three years; a machinist by occupation, was admitted to the medical ward June 15, 1904, Dr. William Porter, Jr., being the attending physician.

Family History. Negative.

Personal History. He had measles, mumps, diphtheria, and scarlatina, the last when he was in his fifth year. Following the scarlatina there was a discharge from the right ear for some years. About the time this otorrhœa ceased a similar condition began in the left ear and has persisted ever since. The discharge, described as "whitish," has not been profuse in amount. At times his hearing has been affected.

Present Illness. Began May 27th, nineteen days before admission, at which time he complained of pain in the left ear. Synchronously

with the pain the discharge became profuse in amount, purulent in character, and very fetid. Twelve days after the onset of his illness the discharge became less and the pain more intense. The next day he began vomiting, which continued for three or four days.

For the past two weeks he has seemed dull. The headache has been severe, the patient crying out with the pain at times. During the past two days he has been delirious some of the time.

He was sent to the hospital by Dr. E. Terry Smith, who believed a brain abscess was present.

Complaint is of severe pain over the squamous part of the left temporal bone, which radiates both to the base of the skull and the frontal bone.

Physical Examination. He walked in the hospital with assistance. Looks very ill. Cerebrations are slow and he is drowsy. He is very deaf. Slight ptosis of left upper eyelid. Pupils are equal, moderately contracted and react. Tongue is dry and brown in the centre, moist and coated on the sides. When protruded it deviates slightly to the right. Breath is foul and teeth are in good condition. There is a slight seropurulent discharge from the left ear, the membrana tympani of which is wanting. There is no tenderness over the left side of the head, but the patient complains of pain just above the left zygoma and anterior to the left sternomastoid muscle on a level with the hyoid bone. He has optical aphasia—that is, misnames objects. This was noted two days before admission.

All the reflexes are slightly exaggerated. The grip of the hands is equal. Tactile sensation absent from thighs and legs but pain sense is preserved. Stroking sole of right foot (Babinski phenomenon) elicited neither plantar nor dorsal flexion. Normal on the left side.

Lungs. Negative.

Heart. Apex fifth space 3¼ inches from midsternal line; not enlarged; systolic murmur heard all over the præcordium, loudest in the second left space, and is transmitted slightly to the left. Over the aortic area there is a to-and-fro "swishing" murmur. Pulmonic second sound slightly accentuated. Abdomen, negative.

June 16th. Condition in the morning the same as the night before. Toward evening drowsiness increased and he was aroused with difficulty. No pain was complained of. The leukocytes were 16,000. A lumbar puncture was made and only a very small amount of fluid was obtained, which contained neither pus cells nor bacteria. At 10 P.M. Dr. H. G. Howe trephined three-quarter of an inch above the external auditory meatus. The brain bulged into the opening and did not pulsate. After the dura was incised a grooved director was introduced downward, forward, and inward and two to three ounces of pus were evacuated. The opening was enlarged, the cavity irrigated with saline solution, and a rubber drainage tube

introduced. Except that he was somewhat delirious the first few days after operation, his recovery was uneventful. The aphasia persisted for a number of weeks, but eventually disappeared. Streptococci and staphylococci were found in smears made from the cerebral pus.

That otitis media, one of the most common complications of scarlatina, is occasionally followed by cerebral abscess makes this particular type the most deserving of consideration. Allport,[3] of Chicago, estimates that there are 4000 cases of otitic brain abscess annually in the United States, and 12,000 in Germany.

They usually occur from a chronic otitis, Grunert stating that only 9 per cent. are caused by acute otitis, while Jansen estimates the number at 17 per cent.

The infection from the ear may reach the brain by the perivascular lymph spaces, by the blood or along the acoustic or facial nerves. It may also occur by direct extension when the roof of the tympanum is eroded by long suppuration. In 40 cases Körner[5] found the bone was diseased directly to the dura in 37 (92 per cent.); the bone was diseased but not to the dura in 1 (2.5 per cent.), and the bone was found to be healthy in 2 (5 per cent.).

When primary infection starts in the tegmen tympani or in the anterior mastoid cells the temporosphenoidal lobe is involved; if the posterior wall of the middle ear or the posterior mastoid cells are involved the abscess will be in the cerebellum. The most common location is the inferior part of the third temporal convolution. This being a "silent area" an abscess may exist here for a long time, giving few or no symptoms, providing the pus has a free exit through the external auditory canal.

Case III. was unusual in that the abscess was secondary to an acute otitis media, and that it was situated in the parietal lobe rather than the sphenotemporal. The infection must have been embolic in character, the embolus being so small that it was not arrested until some distance from its origin.

In Case IV. the abscess was chronic, causing symptoms occasionally, as the otorrhœa would be temporarily diminished in amount, but not until there was complete cessation of the discharge for a period of six weeks did his condition become alarming.

Aphasia occurring with sphenotemporal abscess is not an uncommon symptom. It is usually of the type called by Freund, in 1889, optical aphasia. The patient, while misnaming articles, yet knows their use. He may call a pencil a knife or a bunch of keys, yet when handed to him with instructions to use it will immediately begin writing. This was present in Case V.

The condition in Case IV. is, however, entirely different. We have here a man completely word deaf to a language of recent acquirement, yet understanding and speaking his mother tongue. This has been observed in conditions other than cerebral abscess,

but I have not been able to find it mentioned as occurring with that condition, though complete word deafness has been noted. It is, as a rule, a slow process, and the order of acquirement is reversed, so that the more recent ideas are first to be forgotten. I recall a case exhibited by Prof. M. Allen Starr some years ago at Vanderbilt clinic, which was a striking example of this phenomenon. The patient was an old man who at one time had spoken three languages, but when seen at the clinic he was completely word deaf, and could be induced by signs to write his name on the blackboard only in French, which was his mother tongue. He had been under observation for some years, and the English that he had mastered last he was first to forget; next the German, that he had learned in early manhood forsook him, and at last the French of his childhood began to fade from his memory.

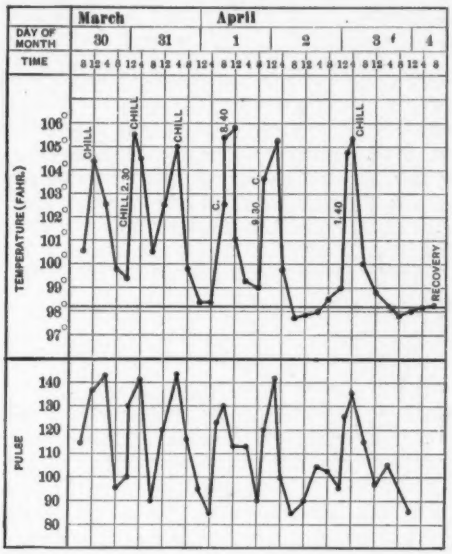
In attempting to describe this phenomenon one leaves the realm of fact to plunge into that of theory, for no one knows just what takes place when nervous impulses are transformed into memory pictures. Every thought or expression of normal consciousness produces a corresponding modification of brain cells. New cells are created and old ones are modified, and these constitute the physical receptacles of memories. We may think that all our ideas, crudely expressed, are "put on in layers," as it were. The cells or parts of cells that were used for our earlier ideas lying deepest, and our more recent mental processes having exploded cells which lie external to them. In the case in point the suppuration involved his English cells, but did not invade the Swedish ones. On the other hand, the symptoms may have been due to some involvement of the association fibres.

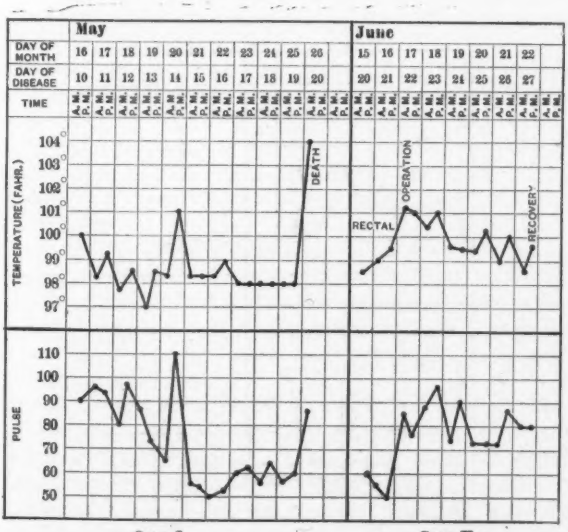
Course. By most writers this is divided into three periods. Many cases of brain abscess begin insidiously, and in these the first period is lacking. On the other hand, those resulting from an operation, an injury, and rarely from an acute otitis media, may have a stormy incipiency. In this latter class the symptoms are those of an acute meningoencephalitis and one may be in serious doubt as to how deeply the suppurative process extends. The patient may recover completely, he may die, or the wound may heal on the surface, but with a pocket of infection in the brain substance, and all the symptoms subside.

This marks the beginning of the second period, spoken of as the dormant or quiescent period, for it is marked by few or no symptoms. The abscess may remain inactive for months or years, or there may be periods of activity occasionally as the surrounding brain tissue becomes involved, these symptoms subsiding as a new capsule is formed outside the recent inflammatory processes. In the majority of cases there eventually comes a third period when the symptoms are urgent, and this is the stage commonly seen by the physician. Left to itself this period terminates fatally either

by rupture into the lateral ventricle, œdema of the brain, or by septic meningitis. Its duration is from two to three weeks; in the 4 fatal

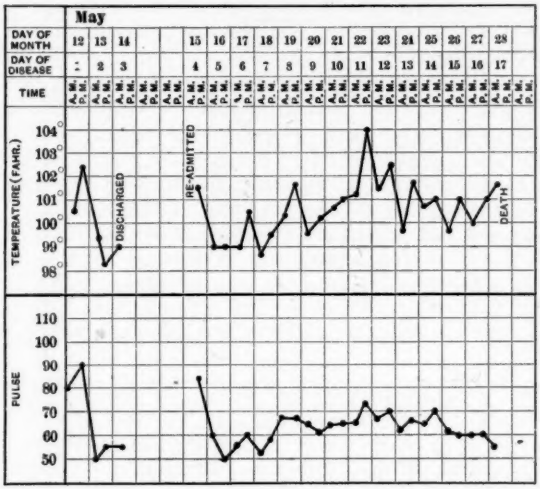
INFLAMMATION OF MASTOID AND LATERAL SINUS.



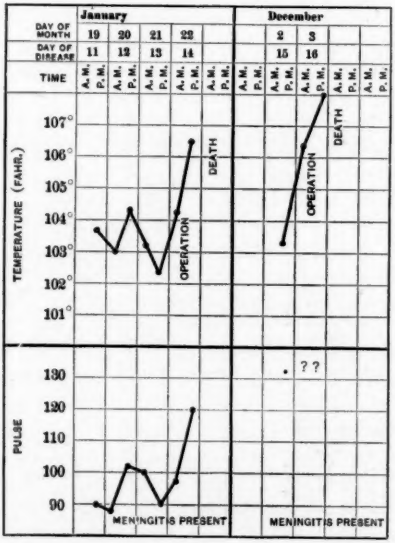


CASE I. CASE V.

cases herein reported the average duration was seventeen days. Spontaneous absorption never occurs. In one of MacEwen's cases,



CASE II.



CASE IV. CASE III.

in which the abscess was in the sphenotemporal lobe, rupture occurred into the middle ear and the pus was discharged through the Eustachian tube.

General Symptoms. *Headache* is usually the first symptom. It may be of any degree and is usually severe. Many observers state that it is not more marked over the region of the abscess. In each of this series, however, it was so localized during some part of the illness. The severity appears to bear no relation to the size of the abscess, but depends probably upon the amount of pressure.

Vomiting commonly occurs and may be projectile in type. It may be spontaneous, as in Case IV. and V., or only occur when something comes in contact with the gastric mucous membrane, as in Case I. It is usually more pronounced when the cerebellum is involved, yet was entirely absent in Woodward's case.[7]

Temperature. . Except for the acute cases the temperature is usually normal or subnormal. When raised a complication is indicated; usually a thrombosis or a meningitis (see charts); less commonly some purulent focus elsewhere, as in Case II., where a small fetid cavity was discovered in the lung. Okada studied 88 cases as to this symptom and his results were as follows: 44 had a temperature; 15 nearly normal; 15 subnormal; 8 fever at the beginning; 4 fever just before death, complication (?). Note Charts III. and IV.

Pulse is slow, becoming slower as the pressure increases. When rupture occurs it is rapid and weak. Osler states that a rapid pulse is the rule, though it may be slow, thus differing from most other observers. *Respirations* are not constant; they are more often slow and in Case V. were sighing.

Convulsions "do not occur very frequently" (MacEwen, op cit.) and are observed when either the motor area is involved or the pressure is markedly increased. In this series two had convulsions. Athetoid movements occurred in Cases II. and III., and in the latter case were more marked on the side opposite the lesions. The eyes are found to look toward the lesion in most cases, but were not constant in Case II.

Paralyses may follow the convulsions and are often temporary. Ptosis occurs on the side of the lesion as the third nerve becomes involved. The facial nerve may be paralyzed from the pressure of a cerebellar abscess on the meatus internus of the same side; or pressure on the pons may cause paralysis of the same side, the opposite side, or both sides.

Optic neuritis occurs less regularly and is less marked than with tumor of the brain. It is, as a rule, unilateral and more marked with abscess of the cerebellum. It is a source of much regret that these cases were not examined for this condition. Lesions of the sphenotemporal lobe are in some cases attended with marked hysterical symptoms; at other times a voracious appetite has been

noted.[6] The bowels are usually constipated, and in the urine a trace of albumin and a few casts are regularly found. A leukocytosis is present when a meningitis or thrombosis coexists, or when the pus is not encapsulated. Accordingly one would expect an increase in the leukocytes during the first period, especially if of traumatic origin, and during the last days, or hours, of the third period. When, however, a firm capsule is present and no complication has arisen the leukocytes may be normal (Case II.), or slightly increased (Case V.).

DIAGNOSIS. The first step at arriving at a diagnosis of brain abscess consists in finding a possible cause. Unless one exist we are in all probability dealing with some other condition.

Inquiry and examination should be most careful, therefore, for the detection of an otitis media; a suppurative process in the nose; an injury to the head, or some purulent pulmonic condition. The injury to the head must needs have been of some severity, for cases like No. I. of this series are very rare. In fact, Oppenheim[3] states that a contusion alone cannot cause an abscess of the brain.

Having found a cause, and with some or all of the symptoms mentioned, the diagnosis can often be made. One should not forget that nature does not always use the same signals in beckoning the surgeon, and departures from the usual symptomatology are but uncommon. This is due to the complications that may arise, any one of which can materially alter the symptom-complex. Moreover, the patient should be under careful observation for a considerable time, as important symptoms may be present for a short time only and not very marked when they occur.

MacEwen considers percussion of the skull to be of value, for, as the lateral ventricles become distended, especially in cerebellar abscess, the note becomes more resonant. To determine this accurately the head should be shaved. He also mentions chills or chilly sensations being associated with the early days. They were not present in any of this series.

DIFFERENTIAL DIAGNOSIS. *Meningitis* differs from abscess in that the onset is more sudden, the temperature higher, and in the occurrence of photophobia and hyperæsthesia. Then, too, König's sign and the retraction of the neck are regularly present. A leukocytosis occurs early. The spinal fluid is increased in amount and contains pus cells and bacteria. In Case V. it was sterile.*

Brain Tumor. There exists no cause for an abscess. Headache is worse and the optic neuritis is more constant, more marked, and sually bilateral. Frequently the diagnosis cannot be made.

Inflammation of the lateral sinus, usually a thrombosis, is associated with great excursions of temperature, a rapid pulse, and

* The importance of a lumbar puncture in differentiating between meningitis and brain abscess was recently impressed upon the author. A brain was explored and no abscess found. *After* operation a lumbar puncture was made and a large amount of turbid fluid was obtained which contained pus and cocci. At the autopsy a general meningitis was found, but no abscess.

frequent chills. This is well shown by Chart VI., which belonged to a patient of Dr. St. John's in the hospital, who had a mastoiditis and extensive inflammatory changes about the lateral sinus, though no thrombosis was present.

Otitis Media. Gowers states that an otitis media may cause all the symptoms of cerebral abscess, even to optic neuritis, but that in most such cases a cerebral involvement coexists. As has been stated, long suppuration frequently erodes the roof of the tympanum, and the abscess is then limited below by the floor of the tympanum and above by cerebral tissue. Now block the avenue of escape for the pus and pressure symptoms will immediately occur. When a paracentesis tympani is followed by a prompt subsidence of the symptoms of cerebral abscess it proves not that an otitis media *per se* was the cause, but that the cerebral involvement is probably not extensive and that the abscess is draining into the cavity of the tympanum.

If the amount of pus obtained is small and the symptoms are severe, the infection has surely extended beyond the ear. This was shown by Case IV. Moreover, if the symptoms do not subside after a paracentesis, the brain should be explored (Case III.).

Epilepsy. In striving to ascertain the etiology of a case of epilepsy one should always exclude abscess of the brain. Cases I. and II. were at first diagnosed epilepsy; in the former the attacks were Jacksonian in type, and in the latter the seizures were those of *grand mal.* When, however, the pulse becomes slow and severe headache and vomiting occur, these at length giving place to increasing drowsiness, we realize that the condition is other than idiopathic epilepsy.

PROGNOSIS. If left to itself when the third period is reached it is fatal. Early diagnosis, followed by early operation, yield most happy results. Of 25 cases reported by MacEwen, upon 19 of whom he operated, 18 recovered. Röpke,[9] in 1901, reported 142 cases with 59 recoveries.

TREATMENT. By prophylaxis many cases will be avoided. All injuries to the head should be made thoroughly aseptic, and inasmuch as a purulent condition in the middle ear and its recesses may infect the meninges and cerebral tissue at any time, these purulent discharges should always be regarded seriously, and ordinary means failing to check them, operative interference is indicated. When, however, the diagnosis of cerebral abscess is reasonably certain, no condition in surgery demands more prompt treatment, for nature does not anticipate a rupture of the pus sac here by the formation of adhesions, as she often does in acute abdominal conditions. "Delay in operating," says Collins,[10] "until the appearance of unequivocal symptoms, or procrastinating by operating on the mastoid after symptoms of brain abscess are evident, is a far greater injustice to the patient than subjecting him to an exploratory

trephine." Even an apparent moribund condition should not deter the surgeon. As MacEwen remarks,[11] "abscess of the brain, like strangulated hernia, should not die unrelieved."

Literature is replete with cases like No. III. of this series, in which the abscess was not located through the first trephine opening and was only found at autopsy. Therefore, when pus is not obtained through the first opening the next most probable site should be at once explored.

When not sure whether the temporosphenoidal lobe or the cerebellum is involved, Dean[12] makes his opening at a point one and one-quarter inches behind and one-quarter inch above the centre of the external auditory meatus. By enlarging the opening upward the cerebrum can be explored and by enlarging downward the cerebellum. When the skull is trephined the brain usually bulges into the opening and does not pulsate, but it has been shown that an abscess may be present even when pulsation occurs.[13]

For operative details any standard surgery may be consulted.

Name.	Cause.	Location.	Headache.	Vomiting.	Convulsions.	Aphasia.	Leukocytes.	Remarks.
Geo. P. Case I.	Slight trauma to head.	Right half of cerebrum	Severe at times over lesion.	Present	Present early of Jacksonian type.	None.	20,000 during last few hours.	Died; a meningitis coexisted; there were distinct localizing symptoms.
Chas. B. Case II.	Metastasis from lung.	Left frontal lobe.	Slight frontal for a few days only	None	Several very severe involving whole body.	None.	7500 to 9000	Contracted pupils after convuls'ns; No localizing symptoms; was much disoriented; died.
Annie P. Case III.	Acute otitis media.	Left parietal lobe.	Severe, at first over lesion, later base of brain.	None	None; athetoid movements more marked in right arm and hand; slight twitching of left upper eyelid.	None.	20,000 few hours before death.	A purulent meningitis was present; died.
Alex. H. Case IV.	Chronic otitis media.	Right sphenotemporal lobe.	Severe over lesion.	Present	None.	Word-deafness to English but not to Swedish.	22,400 few hours before death.	Large abscess evacuated; died; pupils unequal shortly before death.
Jas. G. Case V.	Chronic otitis media.	Left sphenotemporal lobe.	Severe, at first over lesion, later both anter'rly and posteriorly.	Present	None.	Optical aphasia present.	16,000	Contracted pupils; abscess was evacuated; recovery.

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PRIMARY CAVERNOUS SINUS THROMBOSIS.

WITH INVOLVEMENT OF ALL OF THE CRANIAL NERVES OF ONE SIDE, EXCEPT THE AUDITORY, AND WITH PECULIAR MENSTRUAL DISTURBANCES. REPORT OF A CASE.[1]

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MACEWEN,[2] writing in 1893, says: "There is no case on record of marasmic thrombosis occurring in the cavernous sinus alone and none where the marasmic thrombosis originated in that sinus." The case we report is one in which a marasmic thrombosis probably originated in the cavernous sinus and which at the beginning of the disease may have implicated only the cavernous sinus.

Besides the usual symptoms of cavernous sinus thrombosis, there was either a partial or total involvement of nearly all of the cranial nerves of one side, besides peculiar disturbances of menstruation, which probably had a direct relation with the sinus thrombosis. The history of the case is as follows:

J., aged thirty-four years. Her father died of "softening of the brain" after an illness of five years, and one brother of cerebrospinal meningitis. All the members of her family, including her mother, two brothers, and four sisters, are nervous. As a child she had the ordinary diseases of that period, and since has been in fairly good health.

[1] Patient was exhibited before the Philadelphia Neurological Society, April, 1905.

[2] Pyogenic Infective Diseases of the Brain and Spinal Cord, New York, Macmillan & Co., 1893, p. 245.

Menstruation began at the age of fourteen years, and after two periods, during which the flow was very scanty and associated with much pain, her periods ceased altogether for two years; they were then fairly regular. A short time before menstruation began the patient's right eye had become much inflamed and painful; there was some drooping of the eyelid and protrusion of the eyeball.

The inflammation in the right eye subsided somewhat, but at every succeeding menstrual period there was always a considerable sense of discomfort and fulness in the right eye, and later also in the left, even though there was no menstrual discharge. The protrusion of the right eyeball gradually became more prominent and the ptosis more defined, and both these symptoms were more pronounced at each menstrual epoch. About this time she was treated at the Eye Dispensary of the University of Pennsylvania, where the notes state that there was a keratitis in the right eye, the epithelium of the cornea being thrown into folds. No distinct view of the fundus could be obtained, but the edge of the nerve appeared blurred and the retina swollen. There is no mention of exophthalmos. Vision was 20/00.

She married at twenty-four years. Four years after this, at a menstrual period, she noticed that the right eye became more painful and inflamed than ever before and that the drooping of the right upper lid and the exophthalmos were more marked, and that these symptoms instead of subsiding after the menstrual flow desisted, became, if anything, more pronounced. It was only after two months that the menses ceased, and it was then found that the patient was for the first time pregnant. The ocular symptoms had evidently been the first signs of pregnancy.

All of the eye symptoms became more pronounced as pregnancy advanced, which culminated in the birth of twins. Labor was difficult and instrumental. After childbirth the exophthalmos became more pronounced and the ptosis became complete. The patient states that at that time the left eyelid also drooped, but subsequently this disappeared, the other ocular symptoms persisting.

The children died—one at sixteen months, the other at three years. The patient has not been pregnant since, but at each menstrual period the ocular symptoms become, as formerly, more intense. Several years ago she burned a spot on her right forehead with a curling-iron without being conscious of it, and has since noticed a certain numb or dead feeling on this side of the face; this was the first time that she noticed that sensation in the right side of her face was disturbed.

The patient came under our care within the past year with the above history. She now complains of considerable headache, and states that her various symptoms are increasing in severity. The examination of the right eye is as follows:

There is marked exophthalmos, the eye being displaced in the direction of the axis of the orbit. The eyeball can be partially replaced by firm pressure. The third, fourth, and sixth nerves are completely paralyzed. Ptosis is complete, but owing to the prominence of the eye there remains a narrow palpebral fissure. The lids can be brought together by forcible contraction of the orbicularis. The palpebral veins are congested. There is neither bruit nor thrill. The pupil is 4 mm. in diameter and does not respond to direct or consensual light stimulus. The lids, conjunctiva, and cornea are anæsthetic. There is a large corneal opacity with superficial vessels leading to it. Vision = finger counting at $\frac{1}{8}$ M.

On the left side there is slight limitation of the inward excursion of the eyeball and weak and nystagmoid action of all the extra-ocular muscles. The pupil measures 4 mm. and does not react to direct or consensual light stimulus. Vision = 5/X. Field of vision shows concentric contraction.

The ophthalmoscope shows, in the right eye, some atrophy of the optic nerve, with but little alteration of the bloodvessels; in the left eye, slight pallor of the disk, with veiling of its upper inner margin. The veins are extremely tortuous.

Further examination shows that the fifth nerve is completely paralyzed on the right side, both in its motor and sensory distribution, the loss of sensation being strictly confined to the distribution of the right fifth nerve and does not extend to the border of the chin. The masseters do not contract on the right side, and when the mouth is opened the jaw goes to the right.

There is a slight weakness in the distribution of the right seventh nerve, for the patient does not wrinkle the forehead as well on the right side as on the left, and she does not draw up the right corner of her mouth so well.

The tongue when protruded deviates a little to the right, although not always, and shows marked fibrillary tremor on both sides, especially on the right, and atrophy of the right side.

The soft palate is slightly but distinctly weak on the right side, and a piece of metal does not feel so cold on the right side as on the left.

Dr. Grayson very kindly examined the nose and throat and reported that the innervation of the faucial pillars and soft palate was normal. The left vocal cord showed complete immobility and was fixed in the median line. The right cord was functionally active, but showed weakness in sustained tension. Smell and taste were normal.

Dr. Randall very kindly examined the ears and found slight middle-ear involvement on the right side, but no distinct middle-ear disease. There was no impairment of transmission over the auditory nerve.

The examination of the limbs did not demonstrate any untoward

symptoms. The reflexes and sensation were perfectly normal in every respect.

The patient submitted to us her photographs taken at various periods in her life, and one taken about the eighth year showed a distinct but slight protrusion of the right eye and a slight ptosis. It is probable that slight ocular symptoms were present early in life before the patient became cognizant of their presence and that the disease began in the first few years of life.

SUMMARY. A woman aged thirty-four years, with a decided nervous history, but with no history of disease besides those of ordinary childhood, began to have slight exophthalmos and ptosis on the right side probably before the eighth year. These ocular symptoms, with additional pain and inflammation of the right eye, heralded the approach of the first menstrual period. After this the exophthalmos and the ptosis gradually became more marked, but at each menstruation these symptoms were more severe. Four years after marriage the ocular symptoms became intense and persistent, and two months afterward it was found that she was pregnant. The ocular symptoms were the first signs of pregnancy. She gave birth to twins, when it was noticed that the exophthalmos was more marked than ever before and that there was ptosis of both eyelids. The ptosis of the left eye soon disappeared. Examination at present shows a marked exophthalmos and almost complete ptosis of the right eye, with marked venous congestion of the eyelid. There is a slight atrophy of the right optic nerve and pallor of the left. Besides a complete internal and external ophthalmoplegia of the right eye, there is total motor and sensory paralysis of the right fifth nerve, paresis of the right seventh, ninth, tenth, eleventh, and twelfth nerves, and on the left side there is a partial paralysis of the third nerve; in other words, an involvement of all of the cranial nerves of the right side, with the exception of the eighth, and an involvement of the second and third nerves on the left side. The ocular symptoms still become more severe at each menstruation.

Several explanations may be offered for the symptoms present in this patient. Of course, the exophthalmos alone may be produced by many causes, but with the additional involvement of the cranial nerves the usual causes may be excluded. A lesion within the cavernous sinus would best explain the ocular symptoms. MacEwen has shown that in more than one-half of the cases of thrombosis of this channel the process extends to the other side by way of the circular sinus. Such an extension he considers pathognomonic and it serves to differentiate between cavernous sinus disease and diseases within the orbit. In this case we have an involvement of the motor nerves of the other eye.

Having explained the paralysis of the third, fourth, and sixth nerves of the right side and of the third nerve of the left side as being

due to the pressure exerted by a thrombus in each cavernous sinus upon the nerves which pass through its outer and inner walls, an extension backward of the thrombus from the right cavernous sinus into the superior and inferior petrosal sinuses with the consequent pressure exerted upon the cranial nerves of this side would best explain this involvement.

The superior petrosal sinus in its way backward to join the lateral sinus crosses the fifth, seventh, and to a slighter extent the auditory nerve. The inferior petrosal sinus, according to Morris, as it crosses the anterior compartment of the jugular foramen, separates the glossopharyngeal from the pneumogastric and spinal accessory nerves. It receives veins from the medulla oblongata and pons. It is probable that the disturbance of the blood supply caused by the thrombosis of the inferior petrosal sinus is of sufficient consequence to cause a disturbance of the hypoglossus nuclei, and thus account for the involvement of the tongue of each side.

The principal causes of thrombosis are two—marasmic and inflammatory. This case would fall within the first class. It is probable that originally the thrombus involved only one cavernous sinus, but that it gradually extended so as to involve its connecting sinuses. This is borne out clinically by the gradual increase of symptoms.

The peculiar intensification of the ocular symptoms at each menstrual period, especially before the first menstrual period and before pregnancy, in which the ocular symptoms became more pronounced and really were the first signs of menstruation, and in the latter instance of pregnancy, are of great interest.

During menstruation, as is well known, there is a general disturbance of the circulation throughout the body. The exophthalmos in cavernous sinus thrombosis is due to the venous congestion, and it may be that during the menstrual period there is an increase in the amount of congestion, hence the increase in the exophthalmos and the feeling of tension.

If this is so, it is curious that the ocular symptoms should have preceded in the first place the initial menstruation by a week, and secondly, the stoppage of menstruation in pregnancy by two months. It is probable that menstruation and pregnancy first manifest themselves by circulatory disturbances, and that the venous congestion, caused by the cavernous sinus thrombosis, being a point of least resistance, is increased, thus causing the prominence of the ocular symptoms, even before there is disturbance of the menstrual flow. It is interesting to note that no such disturbances have ever been recorded as complicating cavernous sinus thrombosis.

In 1903 Axenfeld[1] called attention to the fact that tumors of the

[1] Neurolog. Centralblatt, 1903, p. 606.

base of the brain may cause disturbances of menstruation, probably through involvement of the hypophysis. Since then Bayerthal[1] has reported a frontal tumor; Abelsdorf[2] a parietal tumor, and Eduard Müller[3] an occipital tumor and three tumors of the cerebellum, all of which caused disturbances of menstruation.

Müller, as a result of the study of his cases and of the literature, arrived at the provisional hypothesis, that it seemed probable that growths of the pituitary body and of the neighboring parts, and also tumors of other regions which develop an early and severe hydrocephalus and a rapid diminution of vision, may be ushered in by an initial amenorrhœa. He presumed in the latter type of cases with great hydrocephalus that pressure would be exerted upon the pituitary body through the infundibular process.

There is, however, no definite pathological proof that the pituitary body controls the menstrual function, for there are recorded cases in which in tumors or lesions of that body no menstrual disturbances existed. It must be remembered, however, that in acromegaly menstrual disturbances are common, and even agenesis of the genital organs has been reported in this disease.

While we believe that the explanation offered in our case for the ocular menstrual symptom is correct, it is interesting to observe that there must have been pressure exerted upon the pituitary body, not only from the cavernous sinuses of either side, but also from the circular sinus in front.

Recently one of us (Weisenburg) was called to see a woman aged thirty-nine years, who had had a hemiplegic attack at the age of fourteen years, some months after menstruation began. The hemiplegia has to a large extent disappeared, but at every menstrual period preceding the flow the patient experiences a creeping, numb feeling in the whole affected side, this lasting for a day. It is an interesting fact that there was directly following the hemiparetic attack a hyperæsthesia for touch and pain in the affected side, which has since entirely disappeared. It would seem as if there was a possible connection between the early partial loss of sensation and the present paræsthetic symptoms manifested at each menstrual period, the underlying cause probably being a weakened vasomotor condition on the paretic side.

[1] Neurolog. Centralblatt, 1903, p. 608.
[2] Klin. Monatsbl. f. Augenheilk, Bd. xli. p. 72.
[3] Neurolog. Centralblatt, 1905, No. 17.

MYXŒDEMA WITH ASCITES: REPORT OF A CASE.

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P. H. B., aged forty-four years, presented himself for examination April 8, 1903. He gave the following history: Since six years he had noted a progressive malaise although his appetite had remained fair and he had gained fifteen pounds in weight in the past year. The family history was negative and no factors of etiological importance could be elicited. His habits had been exemplary in every way and he lived the quiet life of a country merchant.

Although the weather at the time of examination was warm, he was clad in a heavy suit of clothes and two suits of underwear; he still complained that the room was cold. His expression was heavy, the cheeks were full and overhanging, and the puffiness under the eyes was marked. The tongue was thick and showed the indentations of the teeth. The speech was slow and deliberate, but not defective in any way. The vocal organs were unaffected. No dryness of the mouth was complained of and taste was normal. The sight likewise was unimpaired. There was headache more or less constant, and there were pains in the lumbar region which often extended down the legs. The fingers were bluish, cold and clumsy, but not appreciably thickened. The dorsum of the hand was puffy and showed leukoplacic patches which contrasted markedly with the brown skin of the remainder of the surface. The skin over the entire body was inelastic, dry, and scaly. Sensation was not affected. There was no loss of hair. The reflexes were reduced, but present, and the gait was slow and deliberate. The pulse was 60 per minute, very small and difficult to feel. The heart sounds were faint, but unaltered in character. The area of cardiac dulness was unchanged. The abdomen was markedly distended. Dulness extended 3 cm. above the umbilicus. The line of dulness varied with a change in position and a palpatory wave could be clearly made out. The blood count gave red blood corpuscles 4,500,000, white blood corpuscles 1200, hæmoglobin 70 per cent. The leukocyte percentages and the red cells were unaltered. The urine was 1022 specific gravity and contained neither albumin nor sugar. The thyroid gland was impalpable.

The patient was placed at once on thyroid tablets, three five-grain tablets per day. Four days later the condition was unchanged, but the patient declared he felt better, a fact evidenced by the removal of one suit of underclothing. At this time his pulse was 66, temperature 97.2°, respiration 14. Five days later I was sent for because

the patient had developed a fever and was nervous and sleepless. I found him with a temperature of 103°, pulse 120, respiration 26. The pulse was very weak but regular, and the area of cardiac dulness was normal. He complained of faintness and a sense of impending disaster. There were severe pains in the back and limbs. These pains lead the attending physician to prescribe sodium salicylate upon the diagnosis of rheumatism. The thyroid tablets had been continued, although the danger of thyroidism had been mentioned. The tablets were withdrawn for a few days and the evidence of intoxication rapidly subsided. During the short period of acute thyroid intoxication the symptoms of the disease disappeared so rapidly that when I saw him the puffiness of the face was markedly less, and the ascites had entirely disappeared. After an interval of a few days the tablets were resumed and gradually increased to four per day without the reappearance of unpleasant symptoms. After the acute thyroidism had disappeared the heart became irregular both in rate and volume. These untoward symptoms disappeared in the course of a few weeks while the patient continued the treatment.

The patient continues to take from two to five grains of the extract per day and remains well.

The interesting point in this otherwise typical case was the presence of ascites. I can find but one case in the literature[1] where this complication was noted. Another interesting feature was the presence of leukoplacic spots on the backs of the hands. I can find a record of no other such occurrence. It occurs occasionally in exophthalmic goitre, which taken together with the fact that they became markedly less under specific treatment, may indicate some relationship to thyroid disease. The acute thyroidism was typical and is of interest only because of the relatively small dosage required to produce it.

SPINAL CORD DEGENERATIONS IN A CASE OF ACROMEGALY, WITH TUMOR OF THE PITUITARY REGION.

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(From the Laboratory of the Danvers Insane Hospital.)

The following report is of a case which clinically presented symptoms of acromegaly and anatomically a large tumor of the pituitary region, with degenerations in the optic nerves and non-systemic

[1] Godart, Un cas de myxœdeme avec asite. Soc. royal des sci. med. Bruxelles, 13 Juliet, 1895.

degenerations in the posterior columns of the cervical region of the spinal cord:

Although there are many observations on the association of tumors of the pituitary region with acromegalic symptoms, we have found few records of spinal cord degenerations of the peculiar type and distribution which occurred in this case.

The case is that of a woman who, excepting for a sister dying in infancy, had a negative family history. She had been a housekeeper, and until she was forty-nine was in good health; at that age she began to fail physically, at times she had attacks of "cramps" in the abdomen; these were sometimes so severe as to cause her to fall. She was for some time an inmate of an almshouse, where she developed a mental change, becoming indifferent, irritable, and unclean in her personal habits. In April, 1902, she was admitted into the Danvers Hospital. Her age then was fifty-one; she was quite feeble and could hardly stand alone. Her skin appeared sallow and pasty, and while it seemed as if there was œdema of the subcutaneous tissue, there was no pitting on pressure. The face was peculiar, in that the nasal arch was broad and prominent, and the facial diameter between the malar bones greater than common; the supraorbital arch was strikingly prominent, these giving the face a peculiar, broad appearance. Her voice was deep and hoarse. The hair of the scalp was thin and gray; there was scarcely any hair in the eyebrows, and the axillary and pubic hair was entirely absent. The breath was foul. The heart's action was weak, with slight lengthening of the first sound. The respiratory murmur was harsh anteriorly over the upper chest. The temperature was subnormal, sometimes as low as 97°. Urine free from albumin and sugar. A gynecological examination showed that the mucosa of the vagina was atrophic; the upper part of the canal had been deformed by adhesions, and the cervix was not invaginated. Menstruation had always been regular. Although married, she had never borne children. The menopause occurred at thirty-three. There was considerable tremor of the tongue and lips. The pupils were of moderate width, and while they did not seem to react to light, it was noted that their examination was difficult. The knee-jerks were equal and slightly exaggerated.

Mentally she was completely disoriented for place and time. She understood questions, but the answers were given slowly. One week after admission she could not tell when she came nor answer the simplest intellectual tests. April 19, 1902, a treatment with thyroid extract, gr. 2, t. i. d., was begun. A month later she had improved considerably; she was oriented, answered questions clearly, and was inclined to be excessively talkative. She professed an inability to remember coming to the hospital and explained her present situation as due to persecution, viz., "a certain man had turned electricity on her husband and had a spite against her."

Physically she was much better; her skin was less dry and the foulness of her breath had disappeared. She then complained of pain in the lower part of her abdomen and vomited on several occasions; an examination showed no cause for this. A blood count at this time gave 4,300,000 red cells. On May 30th a note stated that she seemed mentally recovered. A test of 4 mg. of tuberculin gave a positive reaction, her temperature rising to 104.2°. Until November, 1902, she continued in an improved condition, yet was always too weak to do more than simple work. The thyroid treatment had been continued, reduced to gr. 1, t. i. d.; at this time she had a rise in temperature and complained of severe pain across the back and lower part of the left side of the chest; numerous fine rales could be heard over these regions; she gradually recovered from this condition, an irregular temperature continuing for some time after the acute symptoms disappeared. During the following two years her condition varied; during the summer she was quiet, busying herself with simple tasks, complaining little; in the winter she was less well, complaining of pains in her bones and chest and that she was always cold. There were frequent rises in temperature; repeated examinations showed no tubercle bacilli in the sputum. August 24, 1904, it was noted that she had gradually failed, became more stupid, and slept much of the day; she took no notice of her surroundings and answered questions poorly; she was unable to walk and complained of pain in her legs and arms; her breath again became foul. At that time neither knee-jerk was obtained. The right Achilles reflex was obtained, but not the left; wrist and elbow-jerks present, pupillary reactions not determined. Her failure was then more rapid, and the stupor deepened so that she could only with difficulty be aroused. Her temperature varied from 100° to 102°. Death occurred August 31, 1904.

The autopsy was performed four and a half hours after death by Dr. Hoag. Female body, aged sixty-six years, 165 cm. long. Large bony development, fair nutrition. Skin in general is pale. No œdema. Over sacrum is a small superficial decubitus. Faint postmortem hypostasis over dependent surfaces. Slight rigor. The nasal bones are prominent, nose strikingly broad, greatest width of bony arch 31 mm. Lips thick, slightly everted. Scant amount of hair in eyebrows and eyelashes. Pupils: right, 7mm.; left, 5 mm. Slight contractures of legs. Breasts show no projecting nipple, very faint areola of pigment.

Heart. Weight 270 gm. Epicardium and endocardium normal. Myocardium not notable in the gross. Valves normal save mitral. Mitral valve 2.25 inches along free edge. Valve cusps much thickened and joined together firmly by fibrous tissue. Chordæ tendineæ much thickened and shortened,

Lungs. Each lung is voluminous. Normal save slight hypostatic congestion with prominent superficial lymphatic tracery. Peri-

bronchial lymph nodes enlarged to 3 cm. by 2 cm. The main portion of the node is dark-brownish red and of normal consistency. On section numerous conspicuous light gray opaque spots, either single or closely packed about 2 mm. across, occur, appearing more definitely placed than normal lymphoid tissue and rather resembling either firm conglomerate tubercles or small metastases of tumor.

Gastrointestinal Tract. Stomach not notable. Intestines normal.

Pancreas. Not notable.

Spleen. Weight 160 gm. Capsule normal. On section the organ shows a large slightly pale reddish irregularly pyramidal region, some 3 to 4 cm. across superficially and abruptly narrowing inwardly. The lesion is slightly firmer than the surrounding splenic tissue. Tissue elsewhere shows only slight injection and slight diminution in consistency.

Liver. Weight 1220 gm. Capsule normal. Section shows the liver tissue to be relatively normal. Appearances of moderate passive congestion. Gall-bladder normal.

Kidney. Weight 280 gm. Capsule strips readily from the relatively smooth surface. The surface presents perhaps half a dozen firm, round, often very slightly elevated, smooth, yellowish-gray zones from 3 to 7 mm. across. Several are frequently grouped together in a small area. On section these are mostly within the cortex, are of pale yellow color, and show the markings of formerly normal tissue in this site. The markings of the rest of the kidney are relatively normal.

Suprarenals. Normal.

Urogenital System. Bladder normal. Externally there is practically no pubic hair, the little that is present is fine and like lanugo. The right labium minus is absent. In place of the left labium there is a dependent tab of integument about 5 cm. in length. Clitoris not visible, externally there is in its place a slight elevation from which smegma oozes. On section there is nothing present resembling the clitoris. Internally the pelvic organs are bound together by many tough fibrous bands of long standing. Uterus very small; its cavity is filled with puriform material; mucosa much inflamed. Tubes can be traced for a short distance. Ovaries not found.

Head. Brain weight with pia 1170 gm. Calvarium not notable in gross examination. Dura mater over the hemispheres is tense. Convolutions not notably flattened. Pia mater clear and delicate. In the region of the chiasm is a large tumor filling the sella turcica and pushing upon the brain and adjacent structure, the mass is soft and firmly adherent to the adjacent dura mater. In the fresh state its limits and relations cannot be determined. The mass seems superficially to be continuous with the brain tissue; on the right side the carotid artery runs along the surface of the tumor, to which it is bound by fibrous adhesions. On the left side the carotid is

buried perhaps 3 mm. beneath the surface of the mass. The optic chiasm is adherent to the base of the tumor and a little widened. The surface of the sella turcica is smooth, save for the adhesions of the dura mater. After hardening in 10 per cent. formalin a more careful examination showed the tumor to be of a round form, with a diameter of 4.5 cm. it consisted, where of greatest size, of a large median part, with a smaller mass protruding up into the left hemisphere to a depth of 3 cm. Both masses considerably distorted the brain contour. The median part pushed up beneath the median septum of the ventricles, while the smaller mass indented the region underlying the head of the striated body and greatly narrowed the left lateral ventricle. Anteriorly there were several smaller protruding masses. The whole tumor could be shelled out away from the brain, and excepting for delicate fibrous adhesions the brain surface was smooth. The right optic tract as it emerged from the brain was flattened by pressure into a thin band, the left tract, although pressed upon by the tumor, was not notably altered in shape. On section the cut surface of the tumor was grayish and finely granular, with streaks and mottlings of a lighter homogeneous substance in the central parts. Irregularly scattered through the mass were small blackened points, evidently representing recent hemorrhages.

Anatomical Diagnosis. Diffuse hypertrophy of nasal bones. Mitral stenosis (extreme endocarditis of mitral valve). Infarction of spleen. Multiple infarctions of kidneys. Sarcoma of pituitary region. Tuberculous adenitis of peribronchial nodes. Anomalies of supraorbital and pubic hair. Anomalies of external genitals. Degenerations of both optic tracts and optic nerves. Degeneration of posterior columns of cervical region of spinal cord.

The microscopic examination showed the tumor to be composed of cells packed closely together and with very little intercellular tissue. While in a few places there seemed to be an alveolar arrangement of the cells, for the greater part this was not common. In greatest numbers were cells with flat polygonal bodies filled with a finely granular cytoplasm, which stained faintly with eosin. The nuclei were large and pale, their outline was oval and sometimes round; commonly they were invaginated or bent on their long axis. These nuclei contained fine threads of chromatin often grouped into skeins. Mitoses were quite numerous, especially along the margin where the fixation was best. Rarely there occurred nuclei showing two or three mitoses. In a few places there were small hemorrhages, some recent, others represented by deposits of pigment. There were a few foci which showed colloid-like degenerations. Rarely there were noticed cells with eosinophile granulations; apart from these there were no cells which resembled any of the elements characteristic of the pituitary body. In its histological structure the tumor corresponded with a sarcoma.

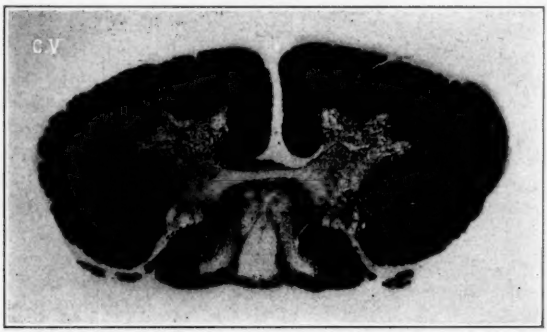
Both optic nerves showed by Weigert's method for medullated fibres, marked degenerations; the right more than the left; the former nerve had one band of stained fibres, perhaps a fourth of the diameter of the nerve, extending along one side and a smaller band at the opposite edge; between these only a few scattering fibres were stained. The vessels were all intensely engorged. The left optic nerve had only a few streaks of degeneration in the central parts. In Marchi preparations there were many blackened fibres in the regions which showed by Weigert's method no degenerations. Similar degenerations were present in both optic tracts.

In the spinal cord there was present a degenerated area in the posterior columns of the cervical regions.

The medulla at the level of the middle of the posterior column nuclei was free from fibre degeneration. In the first cervical segment the posterior median fissure was bordered on either side by two pale streaks; ventrally the two together formed a wedge-shaped figure, while dorsally they diverged, each streak arching outward into the lateral part of the column. The lateral part of the posterior column contained a broader, less compact, and less marked area of degeneration, which with a similar one on the other side, converged below the ventral termination of the median area. Between the lateral and median degenerations the columns contain well-stained fibres. The third cervical segment showed both these areas better marked; they were wider, and ventrally where the two met there was a broad pale area filling the greater part of the width of the posterior column; they were still separated by a band of well-stained fibres. In the fourth cervical segment the areas of degeneration were more compact and paler; at the ventral end they came together; the area of degeneration appeared as a median part with two tapering diverging wings. In the lower portion of the fifth cervical segment the area was still paler than in higher levels; the lateral parts were less compact and ventrally these two came together around the median degeneration. In the sixth cervical segment the median and lateral areas had much the same shape, and in this and the seventh segment were more prominent than in any other level. In the eighth cervical segment the lateral areas had become flattened and the median broadened. At about the second dorsal level the posterior median segment was bordered by two pale streaks, among which there were many well-stained fibres. Both dorsal and ventral to this was a broad uninvolved region. The lateral degeneration was indicated by a slight paleness separated from the median degenerated area. A slight paleness in these regions was noticed in the third and fourth dorsal segments, but below this the posterior columns were unchanged. Nowhere was there any involvement of the entering root fibres; the degeneration where best marked involved those regions which correspond roughly to the middle-root zone of Flechsig.

Where the degeneration was best marked the involved region was of loose structure and marked by numerous vacuoles, the tissue having a porous appearance, which contrasted strongly with the compact medullated substance in other parts of the section. In preparations by other methods there occurred in these spaces and among the fibre masses deposits of finely granular material not unlike in appearance the coagulated substances met with in œdematous tissues; with ordinary tissue stains these regions of degeneration stained very poorly. There were no undoubted epithelioid cells present in these regions; in the neighborhood of some vessels there were large nuclei which stained poorly, but nowhere did they present the picture of granule cells or phagocytes. The glia cells present here were no different from those elsewhere in the section; in preparations by Weigert's glia method no conclusions

FIG. 1



Degeneration of the posterior columns of the spinal cord in pernicious anæmia. Segment C. V. Weigert-Pal stain. × 5.

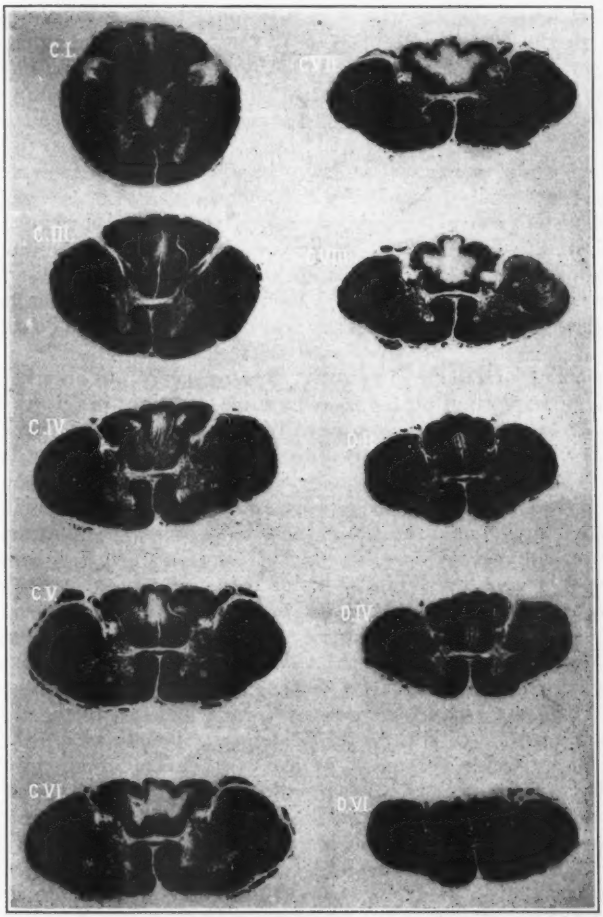
could be drawn further than that there was no increase of fibres in the region of degenerations. In Marchi preparations no blackening occurred in the area of degeneration. As to whether there were axis cylinders still present in the region of degeneration while the myeline sheath had disappeared it was impossible to determine. In good preparations where the axis cylinders were well stained (Bielschowsky's method) the area of degeneration was about equally well marked, and there were no free cylinders of any considerable length not surrounded by a sheath.

The larger bloodvessels, both in the pia and in the posterior columns, showed a considerable increase of connective tissue in the adventitia. The veins and capillaries of the posterior columns are widened and packed full of red cells. In other regions of the cord this was not at all well marked.

In their topographical location and in their histological appearances the spinal cord lesions resembled closely those degenerations

of the posterior columns which have been described in severe anæmias and cachectic conditions. This similarity is readily seen

FIG. 2



Degeneration of the posterior columns of the spinal cord in the cervical and upper dorsal regions. Tumor of the pituitary region with acromegalic symptoms. The paleness in the lateral columns, notably in C. VIII, is due to irregularities in staining and is not a degeneration. Weigert-Pal stain. ×15.

in the comparison of Fig. 1 from the fifth cervical level of a case of pernicious anæmia with those in the present case (Fig. 2). This

resemblance is also borne out in the illustrations in Minnich's[1] monograph and in the studies of Taylor and Putnam[2] and of Russel, Batten and Collier.[3] The degeneration is essentially an intramedullary one; the posterior root fibres and their intraspinal continuations and the zone of Lissauer are free. While it is possible to account for the degenerations in the optic nerves and optic tracts, through the mechanical pressure of the tumor, it seems that the degenerations in the spinal cord are due to other causes. There is nothing in the histological picture which is not in harmony with the explanation of Minnich that these degenerations are due to a localized œdematous process.

There are a variety of conditions in which similar degenerations have been described, in all of which there is a more or less general metabolistic disturbance. Apart from severe anæmias, there have been similar degenerations in the posterior column described as occurring in diabetes mellitus, pellagra, and lathyrismus. The other degenerations described as having occurred in various infections have involved the posterior roots or their intraspinal continuations.

We have found in the literature upon acromegaly four observations on the occurrence of posterior column degenerations in this disease. Arnold[4] described degenerations of the posterior parts of the cauda equina and the posterior roots of the lower lumbar and lower dorsal regions and an ascending degeneration from the lower lumbar into the cervical region of the spinal cord. In Weigert preparations there was a pale area present in the middle line of the midcervical and upper dorsal region. Tamburini[5] found a slight degeneration of the root zone in Burdach's column in the cervical and dorsal regions. Schultze[6] described the posterior columns of the cervical region as being somewhat lighter with rarefied nerve fibres. Duchesneau[7] found degeneration of the root fibres in the posterior column. A further case described by Dallemagne[8] presented in addition to the acromegaly a severe arteriosclerosis of the vessels of the central nervous system, with degenerations in the lateral and posterior columns. In none of these cases does one gain the impression that the degeneration was as marked as in the case we have described.

Degenerations of the posterior columns of the spinal cord are frequently met with in tumors of the brain, and this might be used to explain the degeneration present in the above case. Against this is the fact that in analyzing some 48 cases of degenerations in the posterior columns associated with tumors of the brain, it was found

[1] Zur Kenntniss der im Verlauf der perniciösen Anämie beobachteten Spinalerkrankungen, 1893.
[2] Journal of Nervous and Mental Disease, 1901, Nos. 1-2.
[3] Brain, 1900, vol. xxiii. [4] Virchow's Arch. f. path. Anat., Bd. cxxxv.
[5] Centralbl. f. Nervenh. u. Psychiat., 1894, S. 625.
[6] Deutsche med. Wochenschr., 1889, No. 48. [7] Thèse de Lyon, 1891.
[8] Arch. de méd. expér. et d'anat. path., 1896, tome vii.

that the degeneration either involved the region of the entering fibres of the posterior roots or that the degenerations were entirely different in their topography from those we have described.

The clinical features of acromegaly were not extremely prominent in our case, yet there were present certain physical disturbances common to that disease, namely, the enlargement of the bones of the face, the myxœdematous skin, the thinness and absence of hair, and the hoarse voice, as well as the commonly noted anomalies of the genitalia. In addition there was present the tumor of the pituitary body, which is as yet the commonest finding in the nervous system in this disease.

OPERATIONS FOR RELIEF OF PELVIC DISEASES OF INSANE WOMEN.

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The opinion that a sympathetic relationship exists between the pelvic organs of woman and her mental condition dates back to Hippocrates, who described the mental disorder which is at times connected with menstruation in young women. The doctrine of sympathetic madness had, during the sixteenth and seventeenth centuries, equally as many adherents as those opposed to this theory.

In 1856 and 1857 the Medico-Psychological Society of France held several meetings for the discussion of a thesis by Dr. Loiseau on "Sympathetic Insanity." This discussion was closed in 1857, without any conclusion being reached.

Alienists have now abandoned the term Sympathetic Insanity and recognize in its place that pathological diseases of various organs—as the heart, the liver, the stomach, the intestines, and the uterus with its adnexa—may and do cause, by a long-continued drain, faulty nutrition of the cerebral centres as well as the rest of the animal economy. When such a faulty nutrition is brought about in patients with an already weakened nerve-resisting power, whether from predisposition or otherwise, psychosis may result. Such an insanity is not regarded as resulting sympathetically from the diseased organ, but as being symptomatic of the faulty metabolism and of the cerebral anæmia resulting therefrom, an hereditary predisposition to insanity having already existed.

Müller, in 1868, in an article entitled "Chronic Metritis in its Relations to Psychic Ailments," lays considerable stress on inflammatory conditions of the uterus as causing through the "exhaustive

leucorrhœal discharge" a nervous train of symptoms which he regarded as leading up to psychosis in some instances. This writer was so convinced of the importance of uterine disease in insane patients that he instituted local treatment for all such pelvic conditions existing in the insane patients under his charge, and states that the effect of such treatment was beneficial to their mental state.

C. E. Louis Mayer a year later, in a memoir entitled "The Relations of the Morbid Conditions of the Sexual Organs and Psychology," narrates many cases of interest showing a close relation of cause and effect and warmly advocates local treatment, especially in inflammatory conditions of the uterus and adnexa.

Hergt, of Heidelberg, in 1870, read a paper at Baden entitled "Women's Diseases and Disturbance of the Mind." This article was inspired by the remarks of a surgeon who deplored the neglect of a physical examination of patients entering the insane asylums of Germany.

At the insane institute at Heidelberg, with which the writer of the paper was at the time connected, he states that every patient upon entering the institute was given a thorough physical examination of each organ, as well as a study of their mental condition.

The autopsies in this institution for the two years previous to the writing of this paper showed almost two-thirds as having some disturbance of the sexual organs. No one, he says, contends from this preponderance of pelvic disturbance that a necessary relation exists between disease of the sexual organs and of the mind, since it often follows that one exists without the other. A predisposition, whether hereditary or otherwise, must exist before the pelvic condition can be a causative agent.

He cites instances of mental disturbance not showing any apparent etiological relation to an existing disease of the pelvic organs. However in the course of the mental disturbance abnormal symptoms arose of hallucinations, erotic and lascivious inclinations, apparently the result of an increase of the pelvic disease. A cure of the pelvic condition relieved the patients of the superimposed mental excitement. He gives as the first step in causal influence, when through a sexual disease a more or less weakened condition of the body and of the nervous system is developed, the mental resistance is lessened, and the ground is thus prepared for other more important causes.

Or where a patient, through other causes being greatly reduced in physical and nervous resistive power, may have a disease of the pelvic organs act as the final determining agent of the mental breakdown. Again, a disease of the pelvic organs through the resulting symptoms in some cases affects the whole organism and mind to such an extent as to result in madness through some other trifling cause.

Another class includes insanity apparently the result of menstrual disturbances, also puerperal mania, both of which he regards as

resulting only through an hereditary predisposition. He cites under the head of "acute and subacute inflammation" a number of cases of insanity apparently dependent on diseases of the vulva, vagina, uterus, or cervix, and describes four cases of endometritis with subinvolution and lacerated cervix in which the cure of such caused the mental cure.

I have quoted from this article at considerable length, since it stands even to-day as one of the clearest and most unbiased memoirs written upon the subject by a German alienist.

Pelvic diseases and insanity continued to be brought up in medical literature by occasional articles from those enthusiastic in the causal effect of disease of these organs, and by others equally opposed to ascribing any effect on the mental condition to pelvic disease.

Alexander Skene, about 1878, was invited by Dr. Shaw, then superintendent of the Kings County Insane Asylum, to study the corelation of pelvic diseases and insanity among the women of that institution. His conclusions are given in two articles—one in 1880, published in the *Archives of Medicine*, the other in 1892, read before the American Medico-Psychological Association of that year.

In both of these articles he states as his conviction that diseases of the pelvic organs—though giving rise to a great variety of nervous disturbances—rarely are the cause *per se* of insanity. That the irritation and exhaustion produced by uterine and ovarian disease is simply a predisposing indirect cause and only in those who are already of a poor mental balance.

In speaking of the results of his operation (which were limited) in this institution, he says: "This follows the rule that is observed in other departments of pathology in which two or more diseases are related to each other in the order of cause and effect. The secondary disease does not always disappear when the primary one which acted as the cause of the other is cured. This defines the limits of the success which the gynecologist may expect to have in practice among the insane."

MacNaughton Jones quotes Martin, of Berlin, as stating that "Healthy women do not run the risk of insanity from their sexual organs, nor are they endangered as to insanity by operations upon them. Only by the presence of abnormal mental conditions do menstruation, gestation, or operations on the sexual organs cause mental instability or temporary insanity."

Ripping, a German alienist, warmly denied, through an article in 1881, that any relation existed between psychosis and pelvic diseases in women.

Manton, of Detroit, is more prominent than any other gynecologist as having done a large amount of valuable surgery among the insane women of the Eastern and Northern Michigan Asylums. He was appointed in 1889 as gynecologist to the Eastern Asylum. Credit is due the authorities of this institution as being the first to appreciate

the necessity of systematically relieving the distress resulting from pathological pelvic conditions among their female patients.

While Skene's connection with the Kings County Asylum was ten years prior to this, it was, however, short and did not apparently involve the systematic relief of pelvic distress.

In 1897, at the meeting of the British Medical Association held that year at Montreal, Rohé, Medical Superintendent of the Second Hospital for the Insane of Maryland, reported 34 gynecological operations resulting in eleven mental cures and nine mental improvements. His operations covered a period of six years.

At the same meeting Hobbs, of the staff of the London Asylum of Canada, reported 80 gynecological operations with 30 mental cures and 18 mental improvements. His operations extended over a period of two and a half years.

The results reported by these two alienists were so much more favorable than those obtained by means of the recognized line of moral and therapeutic treatment as to attract the universal attention of all interested in treating mental diseases, giving rise to a number of articles upon the subject. Notably one by Dr. Russell, Medical Superintendent of Hamilton Asylum of Canada, who in an article at the same meeting strongly opposed the validity of the claims of surgery as a curative measure in insanity. He gave in support of his opinion the expressions of 120 alienists of America and Canada, with whom he had corresponded upon the subject.

Shortly after Angelucci and Pierraccini published an exhaustive thesis in opposition to surgical measures as a remedial agent for insanity. They reported 109 operations collected from various sources, resulting in 17 being benefited; out of this number improved they claimed that only 5 true cases of psychosis could be said to be apparently cured.

Both Rohé and Hobbs attributed their high percentage of mental cures to the removal of the diseased uterine adnexa in patients in whom existed delusions referable to the pelvic organs, Rohé expressing the conviction that in patients in whom the delusions were aggravated by the menstrual epoch a removal of the adnexa would be expected to yield the best results, whether diseased or not, while Hobbs relied upon an examination under anæsthesia in order to determine the minor disease or healthfulness of the ovaries—upon the results of which findings depended their removal.

The radical views of these two operators have not been accepted either by surgeons or alienists. Especially is this true as to the removal of normal ovaries or those slightly cystic. Such a procedure is now unreservedly condemned by all conservative surgeons.

Through the writings of Manton, who has been operating for a decade at the Eastern Michigan Hospital, and the reports of Rohé and those of Bucke and Hobbs, the opinions of the medical directors of the various insane asylums have undergone a marked change,

from a position in some instance of violent opposition to any surgical procedure except in emergencies, to one permitting and in part advocating surgical operations where needed. The larger number of these hospitals now include on their staffs surgeons and gynecologists, and operations are done to a greater or less extent for pathological conditions.

Noble, of Atlanta, in a symposium before the American Medical Association of 1900, on the corelation between pelvic and nervous diseases, addressed a circular letter to the physicians in charge of all the asylums of America and Canada. All who expressed any opinion stated that diseases of the pelvic organs were exciting and contributing causes to insanity when they affected the general health of patients who were predisposed to such a mental state.

Maban, formerly Medical Superintendent of the Ogdensburg Asylum and now President of the Board of Lunacy, under the control of which body are all the insane of New York State, in reporting to the American Medico-Psychological Association the results of the surgical work of all kinds done in the asylum at Ogdensburg—then under his charge—says: "Surgical diseases existing in those predisposed by heredity to insanity, and causing them general ill health, are also in a number of cases undoubtedly causal factors of the insanity itself, and should be so recognized."

Further on he says: "In concluding we would emphasize the fact that medical and moral treatment does not meet all the requirements of psychiatrical practice and that therefore we should leave no stone unturned in endeavoring to treat our cases individually, according to their several needs."

In speaking of the physical relief offered the thirty-three patients operated upon and that this relief, demanded on account of the suffering, should be alone the guide for an operation, he closes by saying: ". . . while we enjoy the gratification in addition of knowing that in a number of cases mental recovery was directly aided by this course of action."

The frequency of some pathological pelvic condition existing among insane women is large. Ripping states that in the asylums under his charge in Germany 33 per cent. of diseased pelvic organs were found in one hundred consecutive autopsies. Hergt speaks of almost 66 per cent. of diseases of the sexual organs of women being found in the autopsies for two years in the Heidelberg Institute.

Isabella Davenport, of the Illinois East Hospital for Insane, states that during 1898 to 1900, 431 female patients were admitted; of this number 387 were examined gynecologically and 361 pathological pelvic conditions were found.

Danillo reports	69	per cent.	out of	200	patients	examined.
Rohé	"	74	"	"	200	"	"
Hanton	"	81	"	"	100	"	"
Hobbs	"	93	"	"	100	"	"

Picqué, surgeon to the Alien Hospitals of the Department of the Seine, reports 89 per cent.

Anna Hutchinson, of the Manhattan State Hospital West, where my operations on the insane are being done, reports that during the year ending October, 1904, 700 women among the admissions of that year were examined by her; 543 had pathological diseases of the pelvic organs, 77 per cent.; 157 had no disease of these organs. This large percentage given by various writers does not carry with it a necessary indication that there is an essential causal relation existing between pelvic diseases and insanity. We can neither infer that a mental break-down is largely confined to married women, in whom as the result of childbearing we would expect some pelvic abnormalities. This is evident from a late report of the Manhattan State Hospital West, in which is given the number of women admitted during the last sixteen years as almost 13,000, of which 40 per cent. were single and 60 per cent. of whom had been married.

There is, however, a most important conclusion to be drawn, namely, that in all insane asylums a large majority of the women inmates suffer in some form from a disease of the pelvic organs. The character of such disease varies from those of a more trivial nature from which no symptoms ordinarily arise, to those of a graver kind through which the unfortunate patient is a constant sufferer or by which her life may be endangered. With such facts forced upon us it is but just that they be given such relief as would be tendered to others with similar conditions, though without mental disease. Gynecologists cannot appreciate the different phases of mental alienation; they have not had the training which would enable them to do this. No more is an alienist able to recognize that many pelvic lesions and pathological states of necessity give birth to distress and a train of nervous symptoms well known to one especially trained in this work.

It is therefore important for the general welfare of those women confined in institutions that each asylum have connected with it a gynecologist, and that active assistance be given such patients as need his attention.

It was with this end in view that Dr. Frederick Peterson, the late President of the Lunacy Board of the State of New York, warmly advocated the equipment of operating rooms and the systematic performance of such operations as should be indicated.

At this time—1902—I was requested by Dr. Emmet C. Dent, Superintendent of the Manhattan State Hospital West (the female division of the Manhattan State Hospital), to take charge of the gynecological division of that institution.

All patients on entering the hospital are given a thorough physical examination, of which a full record is kept. In addition to this systematic examination a thorough pelvic and abdominal examination is made by Dr. Anna E. Hutchinson, of which a record is also

made and filed. As a result of such examinations Dr. Hutchinson refers to me such patients as in her opinion may be physically benefited by some form of operation or treatment.

It is from these patients so referred that I have advised operative measures in those most needing it. In many instances such advice has not been favorably considered by the guardian of the patient whose written concurrence is necessary before any elective surgical procedure can be undertaken.

In every instance the relief of the local condition alone and the ordinary symptoms resulting have been considered; no cognizance has been taken of the mental state excepting as it precludes for the time any form of surgical operation. In other words, no operation has been done with a direct view of its possibly affecting favorably the mental disease for which the patient has been admitted to the hospital.

While the relief of the physical suffering alone has been the object of these operations, the subsequent progress of the mental disease of these patients has been carefully noted with a desire to determine if possible whether the improvement of the general health through the operation has exercised a beneficial effect on the favorable progress of their mental state.

Reliable conclusions upon this question are extremely difficult to draw, since so many other factors enter into the reason of the mental improvement of patients; for instance, there is the moral and therapeutic treatment the patient receives in the institution. Again, some patients with a certain character of mental alienation recover, or are improved without any treatment, while others with the same character of mental disease do not improve even under the most advanced method of care. Deductions to be decisive should be drawn from the result of systematic surgical work, extending over many years. In tabulating my own operations I have arranged them under three heads in order the better to analyze them.

As has been previously stated we have sought to improve the physical well-being of the patient wherever surgical measures could be a means toward this end.

No operations have been undertaken with the direct object of influencing the mental status. The physical status alone has been considered. As a result of this course adopted fully three-fourths of the patients operated on were the unfortunate sufferers of forms of mental disease recognized by alienists as unfavorable and in whom little permanent progress can be made in ameliorating their mental state.

The unfortunates of this class had, however, as much a claim for physical relief as those of more amenable forms of mental disease.

The three classes into which I have divided these operations are: major operations, which include all abdominal sections; operations for displaced uteri, which include also, when present, a repair of

cervical and perineal injuries; finally, minor operations, including a restoration of injuries of the vagina and cervix and uterine endometrium.

These divisions have been made, since it has been claimed by some, notably Rohé and Hobbs in the report of the results of their operations, that the greatest mental improvement has been noted in those operations involving the removal of diseased adnexa. Some authors also express the opinion that malpositions of the uterus are of considerable importance in the mental disturbance of women, while others believe that such conditions have very little bearing on their mental state.[1]

Physical Benefit. The daily population of the female division of the Manhattan State Hospital is about 2500 patients. The yearly admission of new patients is between 900 and 1000.

As a result of the pelvic examination of these patients admitted, fully 75 per cent. have some form of pelvic trouble. Operations have been done only in instances where the patient's life was imperilled, or to remove tumors, or in instances where the condition was such as to give rise to constant pain and ill health or to a train of nervous symptoms.

During the two years and a quarter ending October 1, 1904, 242 patients have been given some form of gynecological operation. Of these there have been 62 abdominal sections, 51 operations for displaced uteri and 129 minor plastic operations.

As a result of all the operations done (242) 112 patients have been physically benefited in a marked degree—107 have been noticeably improved, though not to such an extent as in the previous number.

These figures must carry with them more weight than ordinarily since this institution is the patient's home, where she is seen frequently for a long period following the operation. Of the remaining patients 5 died, of which number 2 deaths were attributable to the operation.

When we bear in mind that in no instance was the mental condition of the patient made worse, either directly or indirectly as a result of the operations, the importance of rendering such surgical assistance as is needed to these unfortunate members of our society, confined by the laws of the State in institutions, becomes evident. In some instances lives have been saved; in others patients who had been bedridden or semi-invalids for a long period of time were restored to excellent physical health. With the exception of a very small percentage all were made more useful and contented members of the community in which they live.

[1] The voluminous character of these statistical tables make it impossible to reproduce them in THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES; they will, however, be found, by those wishing to consult them, in the Transactions of the American Medico-Psychological Association for 1905, in connection with a paper, "A Preliminary Report of the Gynecological Surgery in the Manhattan State Hospital West."—B.

Only within a few years has this necessity of relieving the pelvic diseases of women, who are confined in insane asylums, been appreciated by the medical directors of some of these institutions. To Manton chiefly belongs the credit of bringing about this change of opinion. He has added largely to the literature of this subject and never lost the opportunity of calling attention to the duty of rendering in a systematic manner such relief. As a result almost all the asylums now have gynecologists on their consulting boards. Unfortunately, however, such appointments have in the large majority of cases failed to result in active systematic work. The consultants are only occasionally called upon. This is readily understood when we bear in mind that the physicians upon the active staff of the asylum are engrossed in the study of the various mental phases of the individual patients, and not unless the physical disease of the patient is glaring does he have his attention drawn to it.

The old adage of "out of sight out of mind" is peculiarly applicable to most gynecological diseases in these institutions, and too often are the abdominal and pelvic complaints of the patient ascribed to some delusion.

The fear that operative measures for remedying diseased conditions will aggravate the insanity of the patient can be unhesitatingly discarded. No instance of such an occurrence exists among patients I have operated on. The same statement is made by Manton concerning his own operations covering a period of twenty years, and by Picqué, who has been operating for twelve years among the insane of Paris.

The collection of 109 operations brought together by Angelucci and Pierraccini, in which they state that 23 patients were made mentally worse by the operation, I cannot analyze, having been unable to obtain the original article. If, however, these operations deal with castration for the cure of insanity, and I infer that this is the case, since the article seems to have been inspired by the widespread attention brought to this subject through the publications of Rohé and Hobbs, it can be readily understood that the removal of comparatively normal ovaries could accentuate the psychoses of these patients.

The rare occurrence of true psychosis following gynecological operations upon women not previously insane, has been brought out by Rohé in the *New York Medical Journal* of October, 1893. Here he states that as a result of communicating with all the asylums of the United States and Canada he found that in the course of the ten years prior to 1893 only 25 patients had been registered in all of these asylums, as having become insane after gynecological operations.

Kelly, in his *Operative Gynecology*, states that in an experience of something over 2000 abdominal sections he has had 8 patients who have become insane after operation. Picqué, who has devoted

much attention to this phase of insanity, draws a line between intoxicative psychosis as the result of sepsis, the anæsthetic, alcohol, or iodoform so largely used some years ago, and true psychosis following operations.

He gives as his experience that the latter class include only old people in whom the senile change in the brain is taking place, or those mentally weak in whom there exists an intense fear and dread of operations.

This opinion, as expressed by Picqué, appears to be that of most alienists of the present day. The only cases of insanity following operations coming under my care have been those of septic origin, in which a relief of the sepsis has brought about a slow but steady improvement in the mental state.

It is recognized that a number of well-authenticated cases of insanity have been cured by relief of pathological states which had every indication of being connected with the deranged mental condition of the patients. Reports of these cases have raised enthusiastic hopes in the minds of some that such a means might restore many to a mental equilibrium—forgetting, until forced upon them by frequent failures, that although a diseased pelvic condition may have been the starting point of a psychosis in one already predisposed to such a condition, the effect may continue to persist even if the cause is removed. Especially is this true if the effect is insidious in approach and of long standing.

This holds true as well in the classical treatment of insane patients as in the surgery done for the relief of any exhausting physical condition. When operations have been the means of a cure of the mental condition it has been in connection with the general institution treatment the patient has received, and the earlier such an operation is done, and the hygienic and moral treatment is instituted after the accession of the insanity, the brighter is the outlook for the recovery of the patient.

This is well exemplified by the following:

During the period this paper covers 79 patients were operated on within six months after the commencement of the mental disturbance; of this number there was:

Marked mental improvement	. . . . .	20 patients.
Slight " "	. . . . .	30 "
No " "	. . . . .	29 "

Of those operated on within one year, not including the previous patients, there were 44 distributed as follows:

Marked mental improvement	. . . . .	4 patients.
Slight " "	. . . . .	15 "
No " "	. . . . .	25 "

Operations after one year, 125, giving:

Marked mental improvement	. . . . .	7 patients.
Slight " "	. . . . .	27 "
No " "	. . . . .	91 "

It is readily seen that the patients receiving the most apparent benefit are those operated on and receiving the general treatment offered by the institution early in the course of their mental disturbance. In fact it is generally admitted by alienists that the greatest progress toward recovery must be within the first year of the mental disturbance.

After this the habit becomes more fixed and the outlook from any line of treatment is not bright.

Buche, Superintendent of the London (Ontario) Asylum, presented in a paper before the Medico-Psychological Association of 1900 a full report, up to the time of his writing, of the gynecological operations of Hobbs in that institution. This report included 200 patients. The results were from a mental standpoint:

83	women	recovered.
45	"	improved.
68	"	unimproved.

Of 63 general surgical operations he reports only one patient recovering mentally. In analyzing the different characters of gynecological operations and their effects he finds that the largest number of mental recoveries have been among those on whom operations were done for diseased ovaries and tubes; next in order he ascribes importance to relief of diseases of the uterus; and last, to relief of injuries to the pelvic floor.

Picqué, in his *Surgery among Aliens*, cites 18 selected cases of his own, of which he reports 10 mental recoveries and 4 mental improvements. In examining his report he does not show any larger number of improvements as resulting from removal of diseased uterine adnexa—in fact, the greater number follow a cure of an endometritis with an eroded and lacerated cervix.

Rohé, in his well-known report of 34 selected patients operated on, credits the mental cure of 11 of these patients to the operations done. The largest number of these cured (6) were with simple melancholia and with puerperal insanity. He removed the uterine appendages in 32 of the 34 patients operated on.

Manton, while stating that the surgical operations done by him have materially assisted in the mental recovery of at least one-fifth of the patients operated on, however, says that he has never seen any insane patient recover purely through a surgical procedure.

My own operations among the insane have been done with the object of improving the physical condition of the patient. If as a sequel of the improved somatic condition the mental recovery of the patient has been hastened, I have welcomed such an occurrence as an additional proof of the importance of rendering such aid.

In closely studying the histories of the patients upon whom I have operated, and which are here brought together in tabulated form, we find that of the 242 patients 138 still remain in the institution and 104 have been discharged. Of those discharged 43 are

recorded as recovered mentally; 20 patients of the 43 discharged as cured have had their mental recovery materially hastened as a result of the physical improvement arising from the operations done upon them.

While in the majority of these patients there had been some mental improvement before the operation was done, yet in all of the 20 of which we speak the psychic improvement following the operation was marked, as also was the steady progress toward recovery.

I would not have it inferred that this change for the better was an immediate result of the operation. Such could not be expected, nor did it exist. The improvement commenced generally at the time that the patient began to experience her physical improvement and the relief from her former pelvic or abdominal discomfort.

In this connection it is of value to note the moral effect of the operation. In not a few instances during my operations in this hospital patients in need of surgical work would be transferred from other wards to the hospital ward in such an excited state that it would be a question whether the operation should be done on account of the possibility of the patient injuring herself while recovering from the operation. If the physical condition was of sufficient gravity to warrant us in disregarding the mentally excited state, the operation would be done and sufficient nurses supplied to protect the patient. In not a few such conditions it was surprising to find that additional nurses were not needed, since the patient had at once become docile, free from all excitement, and showed a willingness to do everything she was told. None of these patients, however, were among those discharged as recovered, hence it cannot be stated that the mental benefit accruing was a moral one.

The diagnosis of the character of the mental alienation of the 20 patients whose recovery appeared in a great measure to be due to the surgical relief, is as follows:

Melancholia—chronic	5 patients.
Melancholia—acute	7 "
Mania—acute	2 "
Mania—depressive	2 "
Dementia—primary	4 "

It is seen that the beneficial effect of a surgical relief eventually resulting in a mental recovery is confined in my own experience to those patients whose mental disturbance would be largely influenced by the presence of pathological conditions. It would be but reasonable to expect that abnormal physical conditions existing in a woman of a weak mentality could by constant pain and discomfort and the attendant brooding over her condition, be either the direct or indirect cause of a well-defined mental disturbance. Unfortunately the cure of the physical abnormality in such classes of mental diseases has not always relieved the mental disturbance.

Through the earlier reports of operations done for the relief of insanity, the opinion among asylum physicians became prevalent that such efforts involved the removal of the tubo-ovarian adnexa of patients. As a result a strong opposition was created among the physicians in charge of these institutions against all gynecological work, and it has only been within a comparatively few years that this opposition has given way.

Rohé especially advocated this procedure, and operations of this character are even now being occasionally done.

Kroemer, in 1896, seems to have collected all available reports of such operations to the number of 300, of which he states that 70 per cent. were beneficial. Raimann, in 1903, in an excellent article "On the Causal Relations between Female Affections and Mental Disturbance," reports in full 11 cases in which the hallucinations were referable to the pelvic organs and accentuated during menstruation. In all the tubo-ovarian adnexa were removed, though in some instances they were not diseased, and in only three did any improvement result, and that of slight character only.

Among my own operations it has been my effort to preserve one or both ovaries if consistent with the physical welfare of the patient. Among the operations reported it was necessary to remove both adnexa in twenty-three instances.

Of the seven abdominal sections in which the mental recovery of the patients was largely brought about as a result of the operation, the uterine adnexa were only removed in two.

It is contrary to all experience to expect that the removal of the adnexa, unless completely diseased, can result in any benefit physically or mentally to the patient; unless in some exceptional instance, as in that of a patient reported by Raimann. In this instance the patient was insane at each menstruation, and was free from all traces of insanity during pregnancy. The removal of the ovaries and tubes resulted in a cure of her periodic insanity.

The apparent error into which it would seem, by a review of the literature, that a majority of alienists who are not gynecologists have fallen, is the conception that to attempt to benefit a serious condition, such as insanity, by surgical means, necessarily involves a radical procedure as in the ablation of the ovarian organs. They urge that severe tears of the cervix, associated with an endometritis and a lacerated pelvic floor, while pathological conditions, are, however, of too minor a character to exercise a depressing influence on the mental status of those insane. They forget that the nervous disturbances arising from such conditions are in many instances much more pronounced than from diseases of the tubes and ovaries or of the uterus.

Of the cases reported in which minor operations were done, 10 of those discharged as cured began to give evidence of rapid mental improvement after recovery from the operations. While there was

some improvement before the operations, the rapid improvement was, however, subsequent. The only legitimate conclusion to be drawn is that the improvement was due to a relief from the previous nervous disturbance. Three patients with movable retroversion had their mental recovery hastened by a curettage and a restoration of the uterus to an anterior position.

Uterine hemorrhages are well recognized as aggravating the mental state of insane patients. Picqué and Raimann each report an instance of removing a uterine fibromyoma on account of profuse hemorrhages. In both instances the mental recovery of the patients was a pleasing sequel, though not one that could be anticipated at the time of operating.

Surgical operations upon insane patients are not surrounded with the difficulties we would naturally suppose on first thought. During the recovery period it is a rare instance to find it necessary to exercise any restraint, and then only through the presence of a nurse. No forms of jackets or tying are necessary; in fact such means of restraint are not countenanced in any part of the hospital. They are, however, a little curious, in at times removing drainage tubes and gauze if they can get at them. Recognizing this tendency I avoid all forms of drainage if it is possible to do so.

In closing the abdominal wound in the ordinary method of layers, I use as an extra precaution a few silkworm-gut retaining sutures, in view of the possibility of some extra physical effort on the patient's part. I have, however, not as yet had cause to feel that they have been needed.

The dressings are well protected by adhesive plaster, as in the ordinary way. It is an unusual occurrence to have other than primary union.

The length of time in which I have been conducting these operations is too short to draw conclusions of very great value. Such systematic work must extend over a number of years before positive lessons can be learned. Operations done in most of the hospitals other than by Manton in the East Michigan Hospital, and Picqué in the splendid surgical pavilion of the Asylums of the Department of the Seine, and by myself at the Manhattan State Hospital, are of a character too transitory to permit of drawing conclusions.

We regard these patients as having a right to be relieved of their physical suffering, and where such a relief can be given through surgery it is the desire, in the Manhattan State Hospital West, that such shall be afforded them.

It is in this spirit that these operations have been done, and it is in the same spirit that Manton and Picqué have been operating for years previous. With the physical improvement resulting some of the patients have gone on under the regular hospital treatment to a complete mental recovery.

One such cure of the patient's mental disturbance is more than a balance against many failures. This is especially true where, in no instance in the experience of Manton or Picqué or myself, has the mental state of any patient been injured by the operations done.

RESEARCHES ON THE BLOOD OF EPILEPTICS.[1]

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AND

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In such a disease or symptom-complex as epilepsy, the etiology of which is in many respects still very obscure, everything that may throw some new light on it is to be considered of value. While former investigations on this point concerned themselves chiefly with the condition of the brain, the metabolism of epileptics has of late years also received attention and a considerable number of investigations were made on the urine, gastric secretion, sweat, saliva, and blood of epileptics, treating the subject either with a view of establishing changes of metabolism in general or with the purpose of finding a basis to the theory of intoxication.

The blood of epileptics has been studied largely with regard to its toxic properties. On the other hand, the morphology of the blood—*i. e.*, the study of the formed elements of the blood—has so far been relatively neglected, very few researches existing in the literature in this field.

If it is considered how fruitful the study of the formed elements of the blood and particularly of the leukocytes has been for the understanding of many disease conditions, being a great help in the diagnosis of many of them, it seems justifiable and promising some return, to investigate their behavior in the epileptic, so as to establish some eventual further points in the complicated symptomatology of the disease and to possibly throw some new light on its etiology.

In reviewing the literature we here confine ourselves to the most important contributions, which we render in the briefest form possible so as not to take too much of your time.

[1] Read before the New York State Medical Society, February 1, 1905.

We begin with the investigations of S. R. McPhail,[1] who studied a total of 25 cases, namely:

1st group, 5 epileptics just admitted.

2d group, 5 epileptics who had potassium bromide more than one and less than five years.

3d group, 5 epileptics who had potassium bromide more than five and less than ten years.

4th group, 5 epileptics who had potassium bromide more than ten and less than fifteen years.

5th group, 5 epileptics who had potassium bromide more than fifteen and less than twenty years.

The bromide dose in all these cases was 30 grains of the salt three times a day.

He found that on admission the hæmoglobin was considerably below the normal, averaging 72.8 per cent., with a minimum of 60 and a maximum of 80. The number of leukocytes was 20 per cent. below normal. Both then increased—*i. e.*, the blood improved under the bromide treatment administered at the asylum to all epileptics, and only after fifteen years of bromide treatment did slight deterioration take place.

Smith[2] examined in 50 cases of epilepsy the hæmoglobin percentage, the number of red blood cells, and the specific gravity of the blood plasm during seizures and in free intervals. In the free intervals he found the hæmoglobin percentage to range between 50 and 75, the average being $62\frac{2}{5}\frac{3}{5}$. The red blood cells ranged between 3,200,000 and 5,650,000, the average being 4,520,000 per cubic millimetre. The specific gravity ranged between 1047 and 1070, averaging $1056\frac{4}{5}\frac{3}{0}$.

Smith also paid attention to the proportion of red to white cells, to the granulations, etc., and found absolutely no constant variation from the normal. In a few instances there was an excess of white corpuscles over the normal number in health.

The study of the leukocytes in three criminal "Frenasthenics," 15 general paretics and 12 epileptics (8 men and 4 women), was made by Roncoroni,[3] who found that only the leukocytes with eosinophile granulations offered special interest, and he found these cells often diminished in epileptics, in some cases extremely so (3 per cubic millimetre).

Observations of the condition of the blood during epileptic seizures were made by Smith,[4] Féré,[5] and Pugh,[6] while Capps[7] studied

[1] Clinical Observations on the Blood of the Insane, Journal of Mental Science, 1884, vol. xxx. p. 85.

[2] An Inquiry into the Blood and Urine of the Insane, ibid., 1890, vol. xxxvi. p. 504.

[3] Archivio di Psichiatria, Sciense penale e Antropologia criminale, 1894, vol. xv. p. 293.

[4] Loc. cit. [5] Mémoires de la Société de biologie, 1889, sér. 9, tome i. p. 213.

[6] On Certain Blood Changes in Idiopathic Epilepsy, Brain, 1902, vol. xxv. p. 501.

[7] The Blood in General Paralysis, THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, June, 1896, vol. cxi. p. 650.

the blood of general paretics. As Smith's investigations were concerned chiefly with the specific gravity of the blood we omit them. Féré[1] noticed in seizures an increase of the red cells, with which the hæmoglobin did not hold pace. He explained the increase of red cells by concentration of the blood through loss of fluid owing to secretions, especially of sweat, accompanying them, while the failure of the hæmoglobin of keeping pace with the relative increase of the red cells was explained by the destruction of oxyhæmoglobin by the "nervous discharge" of the seizure. Féré furthermore observed that many of the red cells assumed spherical shape and became smaller than the ordinary ones. Finally, he noticed an increase of the blood platelets to take place during epileptic seizures.

The research most approaching that of the writers in scope was that of Robert Pugh,[2] who in 20 cases made counts of the leukocytes during and after seizures, and in a few of them also in the intervals between seizures. He found in the interparoxysmal period a wide variation in the number of leukocytes. In some cases the leukocytes were found to drop some hours before a fit. They were the cases with frequent fits. In others, and they constituted the majority, there was a gradual drop right up to the paroxysm. In spite of a careful perusal of Pugh's paper, however, we fail to find evidence supporting the latter contention. Whatever figures the author may have in proof of his statement are not given in his paper.

In seizures Pugh found a distinct leukocytosis which showed itself a short time after the fit and attained its maximum from about fifty to seventy minutes after. He found the increase due to the large and small hyaline cells (by which he designates the large and small lymphocytes respectively). The eosinophile cells were increased two to ten hours after the seizure. The leukocytosis in status epilepticus was not so constant and was subjected to wide variations.

Of Capps'[3] investigations we only mention the interesting fact that in the convulsive seizures of the general paretic he also observed a leukocytosis which he says is as sudden as it is pronounced and certainly does not appear until a very short time preceding a convulsion, probably not before it actually takes place.

Personal Research. The writers in taking up the study of the formed elements of the blood as a subject of research had the following purpose in view:

1. To establish in general—*i. e.*, in the periods of freedom from seizures—the condition of the formed elements of the blood.

2. To study the behavior of the formed elements in connection with epileptic seizures—*i. e.*, to determine the following points: (*a*) whether in seizures any changes in the composition of the blood

[1] Loc. cit. [2] Loc. cit. [3] Loc. cit.

concerning its formed elements could be observed; (*b*) whether such changes if found were secondary—*i. e.*, caused by the attack itself; or (*c*) whether they were primary, having causal relation to the seizures themselves—in that case they ought to be found directly or shortly before the occurrence of a seizure and eventually even hours or days previous to one; or (*d*) whether they were simply side issues of the seizures—*i. e.*, having neither a causal relation to these nor being produced by them and being the reaction of some other, say toxic changes, the latter being on the other hand the real cause of the attacks.

To establish point 1—*i. e.*, the condition of the blood of epileptics in the free intervals—19 cases were selected, 8 men and 11 women, all of which had been without bromides for a period of at least two months preceding the examination, and all of which were idiopathic cases, so far as such idiopathy could be determined by an exclusion of the following factors:

I. A history of birth traumatism. However, the statement "prolonged labor" was considered too indefinite to cause exclusion unless accompanied by more specific data pointing to birth traumatism; for instance, asphyxia, convulsions, or coma.

II. Convulsions right after birth. (This group really comes under I.)

III. Eventually acute infectious diseases, if the epilepsy began within two months after the onset of the same, and continued right along. Where the epilepsy sets in at a later date the connection with the infectious disease becomes too uncertain, and such cases were therefore not excluded from idiopathy. Convulsions occurring in infancy during an infectious disease, and then followed by a free interval of years, did not justify exclusion.

IV. Traumatism of head, if there is a distinct connection between the onset of the epilepsy and such traumatism—*i. e.*, if the disease follows within a few days or weeks after such traumatism. Where the interval is one of months the connection becomes very doubtful. In case of a clear history of cerebral injury following head trauma—such as loss of consciousness, vomiting, symptoms of fracture of base of skull, etc.—such history was considered a sufficient cause of exclusion, even if the first epileptic seizure occurred months or years after the traumatism.

V. Cases presenting distinct evidence of organic disease of the nervous system, diffuse or focal—such as hydrocephalus, hemiplegia, monoplegia, multiple sclerosis, etc., including meningitis.

VI. Cases accompanied by conditions which so frequently cause organic changes of the nervous system that it would be unsafe to consider them as idiopathic, even if not giving any clear manifestations of organic involvement of the nervous system. This would throw out all cases of alcoholism and other intoxications, such as Bright's disease, lead poisoning, syphilis, etc.

The methods used were the same as those mentioned in the following section for the "Study of the Blood with Relation to Seizures." The time when the blood was taken varied between 11 A.M. and 11.40 A.M. These are narrow limits of variation if it is considered that breakfast, the last meal preceding the withdrawal of the blood, was taken at 6 A.M.

The results are seen in the following table:

Men.			Women.		
Hæmoglobin percentage.	Erythrocytes per cubic mm.	Leukocytes per cub. mm.	Hæmoglobin percentage.	Erythrocytes per cubic mm.	Leukocytes per cub. mm.
104	5,088,000	7,111	100	4,288,000	10,711
105	5,152,000	6,222	101	5,440,000	8,000
108	5,696,000	6,777	100	4,880,000	7,466
109	6,054,000	9,022	90	4,416,000	7,066
106	5,456,000	8,352	103	5,376,000	8,888
106	5,616,000	6,355	100	5,152,000	6,977
103	4,992,000	8,755	100	5,024,000	8,533
105	5,184,000	9,816	102	5,264,000	9,822
			100	5,328,000	9,466
			94	4,264,000	9,822
			98	4,416,000	6,400
Averages.			Averages.		
106	5,405,000	7,802	97	4,895,000	8,468

This table shows for the men an unusually high average of erythrocytes, 5,405,000, which may perhaps be explained by the colony life. The hæmoglobin, taken with Dare's hæmoglobinometer, showed an average of 106, keeping thus pace with the erythrocytes, as shown by the color index, which is $\frac{98}{100}$. The leukocyte figures show nothing abnormal, the average being 7802.

The women show an average red-cell count of 4,895,000—*i. e.*, about as much lower than that of men, as is found in normal individuals. The hæmoglobin is diminished in proportion, the color index being $\frac{98}{100}$, just as in the men. The leukocyte count is not only relatively, but absolutely, higher yet within normal limits.

A perusal of the table shows that the hæmoglobin and erythrocyte figures vary within relatively narrow limits, especially in the men. This fact increases the value of the "average" figures. For the leukocytes the variation is considerably greater, but this is so normally also.

STUDY OF THE BLOOD WITH RELATION TO SEIZURES. These researches were conducted in such a manner as to fulfil all scientific requirements, taking account of the time of the day, the influence of meals, of fatigue and rest, change of habits, etc.

For the counts of the red cells Gowers' fluid was almost exclusively used and in every case two drops of the dilution mixture (1:200) were subjected to the count. In the counting of the leukocytes $\frac{1}{3}$ per cent. acetic acid was used as a diluter.

The blood dilution employed for leukocyte counts was 1: 20. The area counted was almost in all cases two square millimetres for each drop of diluted blood investigated, and two drops of the diluted blood were subjected to the count.

We abstain from a report of the differential leukocyte counts, as these still need revision.

Of the cases so far studied the research has been complete enough only in two to allow publication of the results. We, therefore, here confine ourselves to a report and discussion of these two cases.

Selection of the First Case. Keeping in mind the purposes outlined in a former paragraph we first endeavored to find a case that would allow us to distinctly compare the condition of the blood in the free intervals with that in and after seizures and if possible also directly before seizures.

For such a comparison cases with several attacks daily seemed unfit, as it was very likely that the two "phases," as we might say, would run into each other, become intermingled. A seizure would come on again before the blood had time to resume what for the patient in question was its normal condition. Even if this as a presumption was not *a priori* proven; the fact that it might be so made the selection of such a case undesirable. Even cases with one seizure every day or every other day seemed to offer the difficulties before mentioned, even although in much less degree. On the other hand, cases with too long intervals had the drawback of giving too few opportunities of studying the relation of the blood condition to the seizures. Therefore intervals averaging about a week seemed to meet requirements about the best. That cases with one single seizure at a time were to be preferred is evident from the foregoing. It was desirable furthermore to take a case with day seizures only, if possible, for a double reason: first, because the surveillance of the patient at night, owing to scarcity of attendants, was not close enough to be certain that a seizure was not overlooked and thus the result of the researches vitiated, and, second, because if a seizure occurred at night this would necessitate transferring the study of the case to the night—an inconvenience hardly needing discussion.

Last of all, the case was to be an idiopathic one for the beginning of the study at least. Later, organic ones could be included for comparison.

To make the selection, the seizure records of all patients of the Colony for the year 1904 were looked over with the kind help of Dr. Donald Ross, and it was surprising to see how the number of seemingly suitable cases became less and less in adaptation to the requirements made. The fact appeared, for instance, that not a single case was entirely free from night seizures, so that finally the choice dwindled down to one case, that of a colored boy who at least had only rare night seizures. A white patient would have been pref-

erable, but none seemed to fill the requirements as well as the colored one. We say "seemed," since later observation made it appear very probable, if not certain, that the case was not one of uncomplicated idiopathic epilepsy, but was combined with hysteroepilepsy. As this discovery only appeared in the later course, however, when the study of the case was well under way, such was not interrupted and seemed to reveal some differences in the condition of the blood in the hysteroepileptic seizures from that of the epileptic one, although we admit that the number of seizures made to establish this difference was not large enough and not sufficiently unequivocal to allow of any far-going conclusions.

The very detailed and accurate history of the patient previous to the beginning of our blood examinations was kindly furnished us by Dr. Donald Ross, to whom we take occasion of expressing our gratitude for the same. While the patient was being studied by us we made clinical observations of our own and the notes recorded during that time are our own, with the exception of the report of a slight intervening illness which we again owe to Dr. Ross.

We subjoin here an abstract of the history, confining ourselves to the most important findings:

CASE I.—Colored man, aged twenty years. No family history of epilepsy, chorea, alcoholism, or tuberculosis.

No convulsions as a child. First epileptic seizure at age of ten. No serious injury, although at age of three struck on forehead with a coffeepot. Fair progress at school. Seizures first chiefly at night at intervals of one or two months, several in succession; recently at intervals of about a week or two weeks and only in the day-time or mostly so. No outcry, no biting of tongue. Aura: feels nervous, shakes one or two hours before onset.

Physical examination reveals nothing abnormal on the part of the thoracic and abdominal organs, circulatory system, nor nervous system, except perhaps that patient shows a marked dermatographia as seen in a great number of epileptics.

Mental condition good for man of his education and race.

Admitted to the Colony on September 27, 1904. The number of seizures from the time of admission to the Colony September 27, 1904, to the time when the blood examinations were commenced—*i. e.*, November 16, 1904—was six. They were all grand-mal seizures and occurred four in October and two in November.

November 19*th. Abortive Seizure* (?). Between 1 and 1.30 P.M. patient was "dazed," and at 1.20 had about half a dozen general contractions, appearing like movements of being startled.

22*d.* Evidently a *grand-mal seizure,* observed by nurse during convulsive state; in the stertorous stage by Dr. Onuf. Had then foam at mouth; pupils contracted, without reaction. Breathing deeply stertorous.

23*d* at 9.42 P.M., *series of seizures, apparently hysteroepileptic.* Patient had within the last forty minutes about twenty attacks of the following kind, the description of which we here render in full.

First, a few twitchings or jerks usually in right arm, then a tonic contraction of neck and back muscles, leading to an opisthotonos attitude, and at the same time to rotation around the longitudinal axis of the body. At this stage one arm usually extended along the body, the other one strongly abducted—*i. e.*, having the opposite direction than that of the first one. Fingers clenched to fists, lower extremities extended. The rotation around the axis of the body in some seizures more than one revolution, in others one, one-half or so.

On reaching the abdominal position in this rotatory motion, the fist several times bumped the floor with considerable force. Head not injured. In some of the seizures a tonic contraction of the facial muscles on both sides, in others not, or at least not marked. Sometimes the rotation around the axis is to the right, in other seizures to the left.

Corneal reflex present all through a seizure and afterward. *Pupils* immediately after a seizure contracted, showing good reaction.

Knee-jerks during seizure not ascertainable owing to the rigidity of the lower extremities; directly after the seizure present on left, apparently absent on right side.

No stertorous stage after seizures, at the most one or two respirations of a stertorous character.

After the last seizure observed, patient regained consciousness very rapidly, almost instantaneously; recognized Drs. Donald Ross, Lograsso, and Onuf; knew where he was and remembered last action directly preceding the seizure.

At this stage no anæsthesia found anywhere, or at least no analgesia.

The seizures remained all purely tonic. No clonic stage. They bore resemblance to hysteroepileptic seizures more than having the character of grand-mal attacks. No foam at mouth. No sweating of forehead. Pulse during seizure was tense and full.

25*th.* *Grand-mal seizure* beginning at 5.25 P.M.—*i. e.*, five minutes after the blood was taken for examination. The description of this seizure, since it was observed by the writers, we here render in full:

A minute or so before it began, patient twice while sitting in a chair darted forward with a staring, absent look. This lasted every time a few seconds only. The actual grand-mal seizure began without a cry while sitting in the chair. Head was bent forward, upper and lower extremities semiflexed. The contractions were clonic almost throughout the attack. Hardly a tonic stage at all. Foam at the mouth. Forehead slightly moist. Pupils almost maximally dilated. Corneal reflex absent at end of attack and still immediately after.

The convulsive stage lasted five minutes. Stertorous stage not very deep. Clapping of hands suffices to make him open eyes. Breathing not typically stertorous, but more that of sound sleep. About ten minutes after onset of stertorous stage can be made to get up and walk around, but does so in a staggering manner like an intoxicated person. When asked what is the matter says, "I had an attack." Q. "How do you know?" A. "I felt it coming; had a feeling about the heart as if I was 'scared.' " After walking a few steps, lays head on a table.

Knee-jerks immediately after convulsive stage absent.

December 1, 1904, 4.30 P.M. *Mental disturbance, apparently a psychic epileptic equivalent.* He left work and ran across an almost dried canal with coat, vest, and suspenders off and about to unbutton his shirt. Asked what was the matter he said, "I want to go home." When asked where he was, he smiled.

5*th. Seizure evidently grand mal,* at 9.45 A.M., forty-five minutes after blood was taken for examination. This seizure was seen only in the postconvulsive stage by one of the writers. This stage, however, bore the character of the stertorous stage of the epileptic attack, and the description of the convulsions given by the nurse who observed it, also conformed to that of a grand-mal seizure, of which we omit a detailed account.

On that day and the second day following, the patient had an affection manifested by a dry, hacking cough, and a few mucous rales, pains in chest, headache, and a slight rise in temperature.

11*th. Possible abortive seizure.* Consisting in pain about umbilicus, soon extending to epigastrium; then palpitation and twitchings of the arms and legs. Pain lasted a few seconds, palpitation about an hour. Evacuation of bowels just after pain. Claims to have such an evacuation before each attack.

21*st. Seizure of unknown nature* while at neighboring village of Mount Morris.

24*th.* Blood examinations discontinued, the last one made yesterday.

January 3 (or 2?), 1905. *Four seizures, probably hysteroepileptic in nature.* Described by the man in charge of the laundry as follows:

Patient twisted himself around, lying once on his "belly," then again on his back, kicked around with his hands and feet in different ways and very violently; did not hurt himself. Had no foam at mouth; was not cyanotic. Each seizure lasted several minutes. After the last one he got up at once, showing no unsteadiness of gait.

4*th.* About 2.22 P.M. *Grand-mal seizure.* Seen by the writers and reported by Dr. Lograsso.

At about 2.10 P.M. he told me that he was to have a seizure, and on enquiry how he knew he could not explain any more than to say

that he felt nervous, and that he was having twitchings of both arms and legs. He looked pale and his eyes very glaring. His pulse was rapid, about 110 per minute, but full and bounding. Just about five minutes before the attack I observed a twitching of both his arms, followed immediately by the twitching of both legs. He had three of these twitchings with a short interval between (about one minute). The last twitching was followed immediately by a "Doctor, doctor," when I observed first his clutching of the hands and his stooping forward on his chair. The clutching was followed by tonic flexion of his forearms, fists pointing toward each other, flexion of his legs, and, to my recollection, also flexion of feet. The whole body was now in a state of tonic contraction. This lasted but a very short time, about one minute, when he passed into a state of clonic contractions of the whole body. The lower jaw was moving up and down very rapidly, he giving a grunt here and there.

During the clonic stage he had foam at the mouth; pupils were dilated, and the corneal reflex absent. There was marked cyanosis of his lips and fingers and throbbing of the carotids. The stage lasted about three minutes in all and was followed by a stertorous state from which he was not very easily aroused by the pricking with a pin. On being aroused and on being asked questions he answered, but his words were indistinct, thick, so that it was hard to make out what he said.

A circumstance not mentioned by us before was the appearance during the convulsive state of a circumscribed erythema of both temples, reaching forward to the external canthus, occupying altogether an area about the size of a palm on each side, and quite symmetrical.

27th. In view of the fact that patient had a number of seizures very suggestive of hysteroepileptic seizures, a thorough examination for hysterical stigmata was made to-day with the following result:

Sensation. Tactile, pain, and temperature sense absolutely undisturbed everywhere except perhaps in an area about the size of a quarter, over both the Achilles tendons, where he does not perceive touching with a piece of cotton. However, as this area is slightly callous, this may account for the disturbance. Muscular sense perfect everywhere.

Vision. No contraction of visual fields, and vision corrected by glasses is $\frac{15}{15}$ on either eye.

Hearing. Greatly diminished on both ears. Hears a watch at distance of about a quarter of an inch from each ear. Normally this watch is heard at about two feet distance from ear. Drums show nothing abnormal.

Smell. Evidently unimpaired on both sides; readily distinguishes camphor, ammonia, and peppermint, but not oil of cinnamon and

oil of cloves; probably does not know oil of cloves, and the smell of the oil of cinnamon used for the test was not characteristic.

Taste. Well preserved on entire tongue.

DIAGNOSIS. It results from this examination that there is only one point that might eventually be taken for a stigma of hysteria, namely, the diminution of hearing, which finds no proper explanation in the result of the otological examination and history, and may therefore be a functional one, although it would be risky to state this as a positive fact.

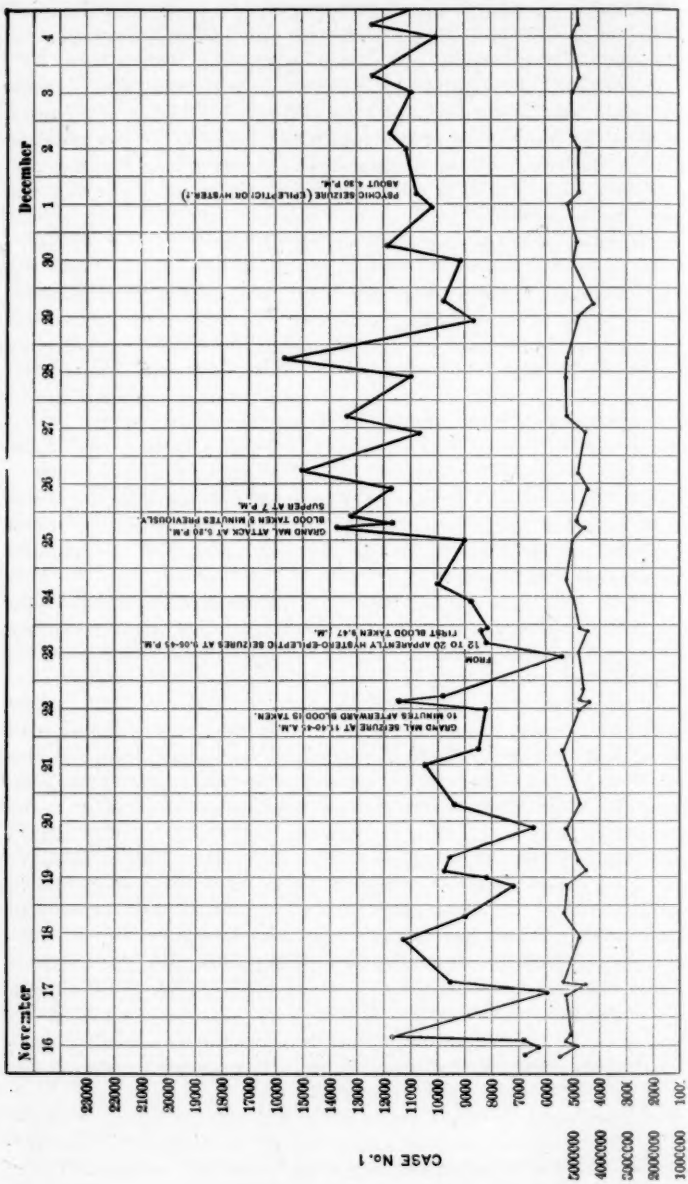
The case, therefore, presents nothing on which to base the complication with hysteria except the nature of some of the seizures. The great number of seizures in a short space of time; the presence of the corneal reflexes during the seizures; the absence of cyanosis, of perspiration, and foam at mouth during the seizure; the absence of the clonic stage; the rapidity with which consciousness was regained, and the practical absence of the stertorous stage are points much in favor of the hysteroepileptic nature of the seizures if contrasted with the grand-mal seizures observed in patients, which were attended by a well-pronounced clonic stage, by cyanosis, foam at mouth, considerable perspiration, and a well-marked stertorous stage followed up by symptoms, which reminded one so much of alcoholic intoxication: the staggering gait, the thick speech, and the marked somnolence.

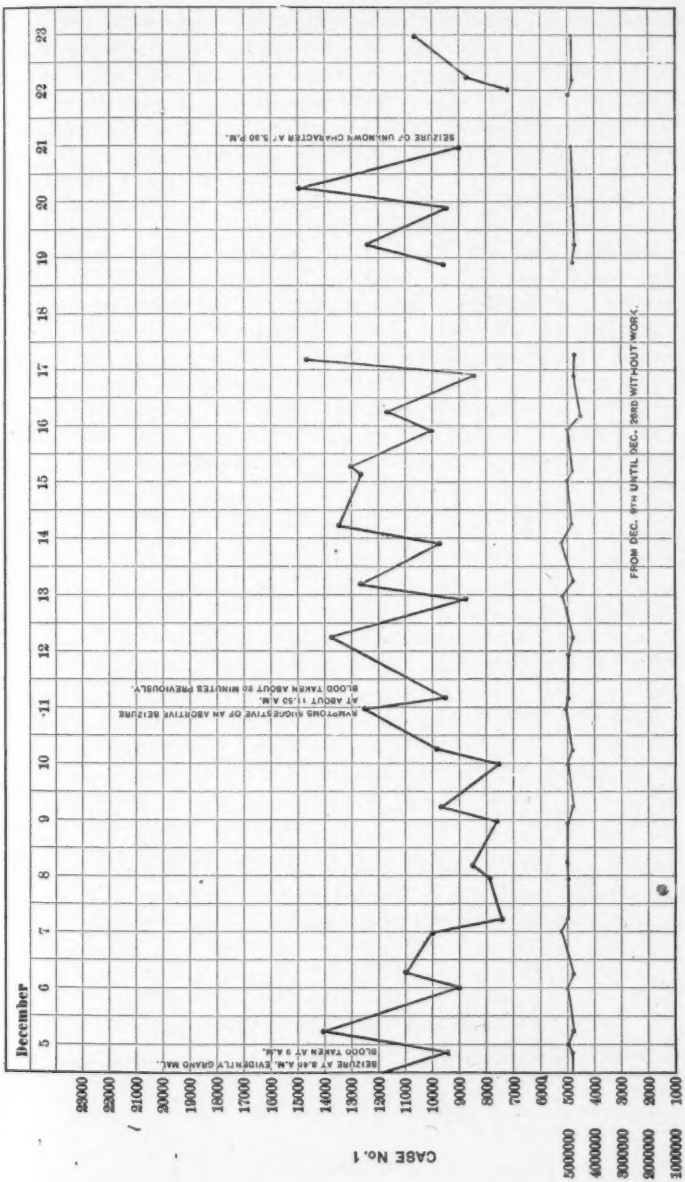
We are aware, of course, that in petit-mal seizures many of the features just mentioned could also be absent, but seizures bearing the hysteroepileptic character described differ too much from petit mal to be mistaken for such.

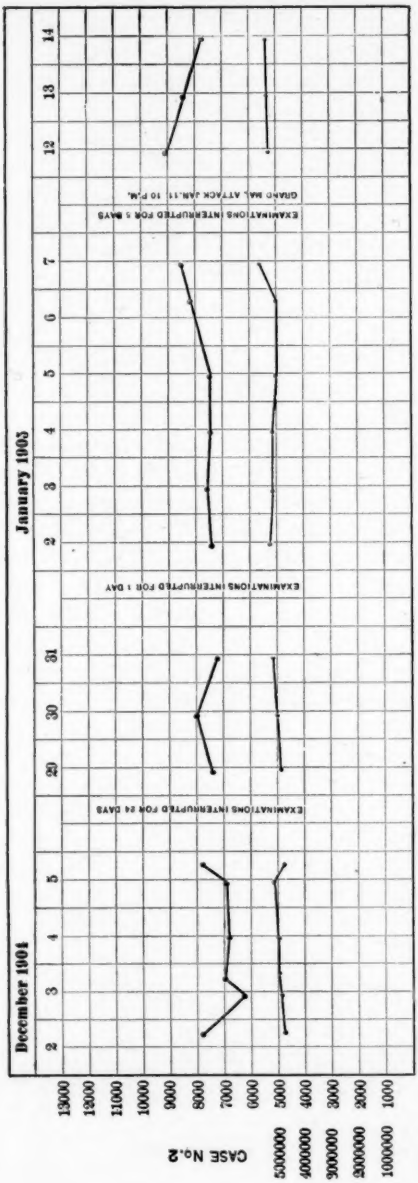
BLOOD EXAMINATIONS OF CASE I. As we already mentioned, blood examinations of Case I. were made twice daily from November 16th to December 23d, and were not interrupted except on December 18th. The examinations were almost all made at the same time, namely, 11.30 or thereabouts, half an hour before lunch, and 5.30 P.M., or very near that time—*i. e.*, from half an hour to one hour before supper. While it might have been advisable to examine before breakfast, this proved practically too difficult to accomplish. When seizures occurred examinations were, furthermore, made during such and at certain intervals after.

The results were recorded in a chart which is here reproduced. The curve for the red cells is rendered by the upper, *i. e.*, heavier line; that for the white corpuscles by the lower, *i. e.*, lighter line. The faint vertical lines represent hours. (For further details see the explanations accompanying the chart.)

On discussing the chart we mention first that the behavior of the erythrocytes offered nothing characteristic or definite. We therefore abstain from conclusions regarding them and simply refer the reader to the chart for their numerical study.


CASE No. 1
November
December
PSYCHIC SEIZURE (EPILEPTIC OR HYSTER.?) ABOUT 4.30 P.M.
GRAND MAL ATTACK AT 5.30 P.M. BLOOD TAKEN 5 MINUTES PREVIOUSLY. SUPPER AT 7 P.M.
FROM 12 TO 20 APPARENTLY HYSTERO-EPILEPTIC SEIZURES AT 9.05-45 P.M. FIRST BLOOD TAKEN 9.47 P.M.
GRAND MAL SEIZURE AT 11.40-1 A.M. 10 MINUTES AFTERWARD BLOOD IS TAKEN.


CASE No. 1
December
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
SEIZURE AT 8.45 A.M. EVIDENTLY GRAND MAL.
BLOOD TAKEN AT 9 A.M.
AT ABOUT 11.30 A.M.
BLOOD TAKEN ABOUT 30 MINUTES PREVIOUSLY.
SEIZURE OF UNKNOWN CHARACTER AT 5.30 P.M.
FROM DEC. 6TH UNTIL DEC. 23RD WITHOUT WORK.


CASE No. 2
5000000
4000000
3000000
2000000
1000000
13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
December 1904
January 1905
2
3
4
5
20
30
31
2
3
4
5
6
7
12
13
14
EXAMINATIONS INTERRUPTED FOR 24 DAYS
EXAMINATIONS INTERRUPTED FOR 1 DAY
EXAMINATIONS INTERRUPTED FOR 6 DAYS
GRAND MAL ATTACK JAN. 11 10 P.M.

On the other hand, interesting observations were made on the leukocytes which we shall here discuss.

Leukocytes. The most marked feature concerning the leukocytes is the fluctuation in the leukocyte count. The lowest figure is seen November 23d at 11.30 A.M., namely, 5333;[1] the highest one November 28th, 5.15 P.M., namely, 15,800; or, in other words, the maximum figure is almost three times as high as the minimum one.

The fluctuations are of two kinds, namely, first, daily fluctuations, and second, ascents and descents extending over longer periods. As to the daily fluctuations we see that as a rule the count taken before lunch is lower than the one taken before supper, but there are four exceptions to this rule, namely, on November 18th and 21st and December 7th and 11th, on which days the morning count was higher than the evening count. *This already indicates that the fluctuations in the leukocyte count cannot be explained purely by the daily influence of meals, work, and sleep, but that some additional factors must be at work to produce them. This conclusion is confirmed by making a further study of the chart, which reveals the presence of elevations and depressions extending over longer periods.* For instance, an elevation is seen to extend from November 23d at noon—*i. e.*, 11.30—to November 29th, 11.30 A.M., or over six days, with well-marked peaks on November 25th, 5.20 P.M., and November 26th, 5 P.M., and some lesser ones. Another elevation reaches from November 29th, 11.30 A.M., to December 7th, 11.15 A.M., and a third one from there to December 17th.

If we now study the relation of the seizures to the leukocyte counts we find the following:

There are three grand-mal seizures recorded during the period of blood examinations. As good luck would have it, it happened with two seizures that the blood had been taken shortly before the occurrence of the same—*i. e.*, on November 22d, ten minutes before a grand-mal seizure, and on November 25th, five minutes before a grand-mal attack.

The result of the blood examination differed for the two attacks. On November 22d the count taken directly before the seizure was 8154, or relatively low; on November 25th, the count taken directly

[1] Per cubic millimetre.

EXPLANATION OF CHARTS.

The distances between the vertical lines of the charts represent twelve hours, so that in Case No. 1 the vertical line under (November) 16 represents noon, that between (November) 16 and 17 midnight, etc. In the original charts each hour of the day was represented by a vertical line. Owing to great reduction in size, however, these lines had to be left out on the plates. But the time of the day of each examination recorded in the charts is indicated by the distance from the nearest "noon"—and "midnight"—lines.

The figures from 1000 to 25,000 represent the number of leukocytes, those from 1,000,000 to 5,000,000 the number of erythrocytes.

The heavier, upper line registers the leukocytes; the lighter, lower line the red cells.

before the seizure was 13,888—*i. e.*, apparently high, representing a distinct leukocytosis.

These two observations show two facts: *First, that a leukocytosis may already be present directly before a seizure, and, if so, is then of course not a purely secondary phenomenon produced by the seizure. The second fact brought out is that a grand-mal seizure need not necessarily be preceded or ushered in by a leukocytosis.*

The third grand-mal seizure falling into the period of the blood examinations occurred on December 5th. Here the blood was taken twenty minutes after the onset of the seizure.

The behavior of the leukocytes after the onset of the seizure differs in the three grand-mal attacks studied; in the one occurring November 22d the number of leukocytes rose after the onset of the seizure, reaching its maximum in two hours or possibly somewhat later. In the seizure occurring November 25th the maximum count had been reached directly before the seizure—13,888—after which, within one hour and forty minutes, it had fallen to 11,800, to rise again within the next three hours up to 13,177, a meal having intervened in the mean time, by which this latter rise could be explained. In the third attack, December 5th, the leukocyte count rose for approximately eight hours after the onset of the seizure. The exact time at which the maximum occurred cannot be stated, as the number of examinations made was not sufficient to exactly state that period.

These observations certainly teach the important fact that there is no absolute parallelism between seizure and leukocytosis in so far as, even when a distinct leukocytosis is present, such may reach its height at different periods in different seizures; they also show that the leukocytosis is, in part at least, independent of the seizure.

The study of the chart further teaches that the marked elevations of the curve do not necessarily mean seizures. This is illustrated by the high evening counts of November 16th and 18th, still more of November 26th and 28th, etc.

Of interest is the fact that the seizure of November 25th was ushered in by a gradual steady climb of the leukocyte count extending over fifty-three hours. But on the other hand no distinct "incubation climb," as we might call it, was observed to precede the grand-mal attacks of November 22d and December 5th.

A further notable fact is the one that the blood taken at the end of the series of hysteroepileptic seizures occurring November 23d showed no leukocytosis, the count being 8288. Neither was such present an hour and thirty minutes afterward.

It seemed to us as if the principal fact that had been brought out by the investigations of this case was the great fluctuation of the leukocyte count. It seemed important to find out whether this fluctuation had anything to do with the epileptic state or whether it was accidental. It seemed therefore desirable to find out whether

such fluctuations occurred also in normal persons and in epileptics who had their seizures at larger intervals. We began the study with a case of the latter kind—*i. e.*, of an intelligent patient affected with idiopathic epilepsy (R.Cl.) whose seizures occurred one every two or three months. The chart of this case (No. 2.) is very instructive.

In the first four days the leukocyte count showed slight fluctuations—*i. e.*, between about 6133 and 7866. The examinations were interrupted on December 5th and resumed December 29th. From that date the leukocyte curve ran very evenly, varying only about 200 leukocytes, until January 5th and 6th, when a distinct rise occurred which reached its maximum of 8755 on January 7th, so far as the examinations went, which unfortunately were then interrupted. On January 11th patient had a seizure. The first examination after this seizure was made January 12th, revealing the highest leukocyte count so far obtained—*i. e.*, 9066. The curve certainly suggests that in the intervening days the count was still higher.

The case, in spite of this unfortunate break in the curve, is very instructive and deserving of further study. It tends to show or to foreshadow that where the intervals between the seizures are long, the fluctuations of the leukocyte count are apt to be slight and to concentrate around the period of seizures, and that the curve is apt to be an almost entirely even one in most of the time of the free interval.

GUNSHOT WOUNDS OF THE ABDOMEN.

A REVIEW OF FOURTEEN CASES, WITH REMARKS ON THE MORTALITY AND TREATMENT.[1]

By George Tully Vaughan, M.D.,
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In my series of 14 cases suffering with gunshot wounds of the peritoneal cavity there were 8 cases of wound of the small intestine, 6 of the large intestine (5 of the colon and 1 of the rectum), 5 of the diaphragm and pleura, 5 of the liver, 2 of the stomach, and 2 of the kidneys. Several patients had a number of wounds in one organ, while in others several organs were wounded; for example, one patient had eleven bullet holes in the intestine, while another had perforation of the liver, stomach, and colon.

One of the patients was not operated on, 1 was operated on late,

[1] Read at the meeting of the Association of Military Surgeons of the United States at Detroit, Mich., September 26-29, 1905.

and 12 were operated on in from one to twenty-eight hours after the reception of the injury.

Nine patients died—a mortality of 64 per cent.—the cause of death in 6 cases, or in 66⅔ per cent., being hemorrhage; in 1 case peritonitis, in 1 case exhaustion, and in 1 case shock or the anæsthetic or both.

I know of nothing more which could have been done to save the 6 patients who perished from loss of blood, except to have operated sooner.

It is difficult to account for the death of Case IV., though the cause is given as exhaustion, unless we are willing to believe that his strong will power and determination to die turned the scales against him.

Case V., which died of shock, and perhaps the anæsthetic, would almost certainly have died without operation from the effects of eight large bullet holes in the intestines.

Case VI. died of peritonitis sixty-nine days after he was wounded. This was a great disappointment, as he should have recovered, and probably would have done so had I drained the peritoneal cavity or removed the bullet before permitting him to leave the hospital.

Gunshot wounds of the abdomen have always given a high mortality, whether in peace or in war, but since the introduction of the modern military rifle, discharging a very small missile with great velocity, the mortality of such wounds has been reported as less than that from similar wounds inflicted by the larger and more slowly moving balls of older arms and of those used outside of the military service. Treves states that only 40 per cent. of gunshot wounds of the abdomen in the Anglo-Boer war not operated on died, but it has been well said (Hildebrandt) that if those were included who died of such injuries on the battlefield and during transportation the mortality would exceed 70 per cent. Haga is quoted as giving the mortality of gunshot wounds of the abdomen in his division during the Chino-Japanese war as 77.1 per cent. In view of the rule, which has few exceptions, that every case of gunshot wound of the abdominal cavity is attended with injury to the viscera, the best method of treatment is generally agreed to be early laparotomy, arrest of hemorrhage, closure of visceral wounds, and toilet of the peritoneum. The only question as to the propriety of this method arises when circumstances are unfavorable for aseptic work, as on the field of battle or elsewhere away from the conveniences of a modern hospital. Under such conditions it is maintained by some that expectant treatment gives the best results. To decide this question would require the study of many more cases than I present, or than have ever yet been reported, and a careful comparison of the results following respectively operative and expectant treatment. That recovery without treatment can follow

perforation of the intestine by gunshot wounds cannot be questioned. The mucous membrane of the stomach and intestine, being of much greater area than the other coats and lying in folds loosely attached to the other coats, often prolapses through an opening in the stomach or intestinal wall, and may plug it so securely that healing follows with little or no infection. Experiments on animals show that such closure occurs only when the opening is less than one-fifth of an inch (5 cm.) in diameter (Klemm).

In Case VII. there was undoubtedly perforation of the liver and injury to the colon resulting in a fecal fistula, yet the patient recovered without operation. In Case XIV. there must have been perforation of the liver and of several coils of intestine by a small bullet, yet this patient recovered after one abscess had opened into the bowel and another had been opened externally. But the results in these two cases do not argue against laparotomy since their recovery was more a matter of good luck than the result of any exercise of good judgment, and the chances of recovery in the second case would have been much increased and his time of convalescence materially shortened by a primary laparotomy. Personally, I am decidedly in favor of early operation, even at the risk of not performing an aseptic operation, because I believe the danger from hemorrhage is far greater than that from any infectious material which may enter on account of the operation; besides, such an unaseptic operation may be the means of preventing infection by affording an opportunity to cleanse the peritoneal cavity and to close openings in the intestine. The sooner after injury the operation can be performed the better. It is bad judgment to wait for the symptoms of shock to pass away before operating, because in this time the patient may be bleeding to death internally, and the symptoms of shock may be due to hemorrhage. One hour is too long to wait if the operation can be done sooner. Valuable time should not be lost in estimating the amount of hæmoglobin or in getting the patient's blood pressure, although there is no objection to making use of these aids to diagnosis, provided the patient's condition will permit it. On opening the abdomen—preferably through the wound of entrance or exit of the ball where such an incision will permit a good command of the field—the surgeon's attention should first be given to ascertaining whether or not bleeding is going on. If it is, it must be controlled before doing anything else. Suture of perforations of the intestine must be delayed until the bleeding has been stopped. With the abdominal cavity almost filled with blood, which returns faster than it can be sponged away, it is often a very difficult matter to find the source of bleeding. The suggestion to control hemorrhage in these cases by compressing the abdominal aorta has not given satisfaction in my experience.

I know of no better plan than: first, to bear in mind the course of the ball as determined before operation, and the organs

which would be most likely to lie in its pathway; second, make plenty of room for manipulation and inspection by means of long incisions, supplemented, if necessary, by cross-incisions; if the source of bleeding does not appear, pack in gauze towels in order to control the hemorrhage as much as possible while a systematic search is made for its source. Examine first the mesenteric vessels—as the most dangerous hemorrhage usually comes from them—tracing them rapidly in their course through the fan-shaped mesentery to form the vasa intestini tenuis and supply the intestine. Next examine the great vascular trunks—the aorta and vena cava—then any other organs as liver, spleen, kidneys, pancreas, bladder, and rectum, which lie in the pathway of the ball.

Having stopped all bleeding, wounds of hollow viscera must then be sought and closed, when found, with fine silk sutures. The bladder, rectum, and ureters should not be overlooked. Time can often be saved if the entire course of the ball is known by limiting the area of examination to this line. For example, if the ball entered at the navel and made its exit just below the twelfth rib on the left side, there would be no need of wasting time in examining the liver, or right kidney, or right ureter. According to my experience the wounded intestine is usually found not to have moved from the position it occupied when wounded. I suppose if the patient should be inverted or violently shaken this might not hold good. An exception should be made in case of the stomach; if distended at the time of perforation the contents might escape and the stomach would contract and possibly withdraw to some distance from the pathway of the bullet. Finally, the abdominal cavity should be carefully cleansed by irrigation with large quantities of warm salt solution, then closed, with or without drainage—the latter if there has been no extravasation of intestinal contents nor the ligation of any large mesenteric vessel. When in doubt it is best to provide drainage.

Wound of the Liver, Colon, and Kidney.

Case I.—S. D., male, colored, aged eighteen years, shot March 5, 1898, pistol ball, 0.32, entering between eighth and ninth ribs in front of right anterior axillary line. Next morning blood was noticed in the urine and patient had vomited twice. *x*-ray located ball in back one and a half inches to right of navel and three inches from the front. Laparatomy. March 6th, about twenty-eight hours after injury, incision along outer border of right rectus, afterward supplemented by a cross-incision just below ribs on the right side. The ball was found to have passed through the right lobe of the liver, edge of the hepatic flexure of colon, and lower part of the right kidney into the muscles of the back, where it was lost.

The wound in colon was closed with silk sutures, also the one in the anterior surface of the kidney; the wound in the liver was not

bleeding and was left alone. Flushing with hot salt solution. No drainage. Recovery rapid, but large *x*-ray burn developed on abdomen, which required a year to get well.

CASE II.—G. A. F., white male, aged thirty-one years, native of Virginia, shot 9.15 P.M. night of May 26, 1898. Forty-five minutes later pulse 84, no vomiting or nausea, some pain in bowels. Bullet had entered left side of abdomen about midway between navel and anterior superior spine of ilium—one inch above this line and a little nearer the navel.

Operation at once under chloroform. Incision through left rectus about five inches, including wound; ten holes in small intestines (eight in lower jejunum and two in ileum); ten openings in the mesentery were found (five perforations of both layers); twenty holes were sewed up, using silk and two rows of sutures in most cases. The pistol ball, a 0.41, was found wrapped in the omentum. About half a pint or more of blood in the abdominal cavity, but no intestinal contents visible. Salt solution flushing. No drainage. Stitches removed the fifteenth day. Recovery without incident.

Wounds of Stomach (Two) and Intestines (Five); Death from Hemorrhage.

CASE III.—J. L., colored male, aged about thirty-five years, was shot about 3 P.M. December 12, 1899, the ball, 0.41, entering the back about two and a half inches to the left of the median line and just below the last rib. It passed through and could be felt under the skin in front about two inches from the median line and one inch below the navel on the left side. Patient in bad condition; pulse 120, extremities cold, vomiting, thirst, and restlessness from hemorrhage. Operation about three hours after injury; ether; incision through left rectus, later joined by a transverse incision to the left near the ribs; the ball was removed, being in the incision. Blood gushed out, probably three pints of clots and blood; seven openings were sewed up, two in the stomach near the pylorus and greater curvature and five in the small intestine, besides two wounds scarring but not opening the intestine were sutured. Flushing with hot salt solution. No drainage. Patient died about one hour after operation.

The three foregoing operations have been published in full, and only a synopsis is given here to complete the record.

Wound of Liver; Death from Exhaustion.

CASE IV.—S. M., white male, aged sixty years, of Ohio, clerk, killed the second auditor for the War Department December 22, 1900, and then cut his own throat and shot himself. An hour later, when seen at the Emergency Hospital, he was in good condition, perfectly calm, but insisted that he did not want to recover

and wanted nothing done for him. He finally agreed to submit to operation. Ether was given and a bullet hole was seen about halfway between the median and left nipple lines and about three inches below the level of the nipple. A probe easily passed through the wound between two costal cartilages into the abdominal cavity. Pulse was 90 to 100 and irregular. Incision in median line from ensiform cartilage to navel. Blood clots escaped and blood welled up from deep within. The ball had passed obliquely through the left lobe of the liver, producing something like an explosive effect, tearing out a piece from the anterior border about one inch in diameter and producing radiating fissures, one of which extended about three inches toward the right lobe and involved the entire thickness of the left lobe. The ball then plowed a furrow in the under surface of the right lobe, thence obliquely downward to lodge under the skin just above the crest of the right ilium without wounding intestines, gall-bladder, or bile-ducts so far as could be ascertained. The long deep fissure in the left lobe was closed with catgut sutures and gauze was packed in the furrow of the right lobe to stop hemorrhage. Wound closed except upper angle, through which projected end of gauze packed in liver.

Patient had slight vomiting daily after operation, but pulse and temperature were good except for irregularity of pulse. The gauze was removed on the fourth day; it was stained with blood and bile. Death occurred December 29th, seven days after operation, apparently from exhaustion. The patient consistently maintained his determination to die, although he appeared to be gentle and tractable as to obeying orders, and this might have turned the scale against him.

Necropsy showed nothing remarkable except a little bile in the abdominal cavity from wound of right lobe; the left had closed as if healed. Only local reparative peritonitis was present.

Eight Wounds of Intestines; Death from Shock.

Case V.—F. M., female negro, aged nine years, shot accidentally with a pistol the night of June 30, 1901. The ball entered the right iliac region, almost exactly at McBurney's point, but a little nearer the navel. A little less than an hour after being shot patient had vomited twice, pulse was 150, and she complained of being cold. Under chloroform the abdomen was opened through right rectus, including bullet wound in incision; blood in peritoneal cavity. Eight holes were sewed up in the ileum, the lowest about two feet from the cæcum. Pulse became very thready and rapid and finally could not be counted; strychnine was given and salt solution under skin, but patient suddenly ceased breathing, heart's action apparently stopped at the same time. Lowering head and artificial breathing for twenty minutes of no avail. Death probably from shock, though operation was not long, about a half hour, and not much blood was lost.

Four Wounds of Intestines; Death after Sixty-nine Days.

CASE VI.—H. S., male negro, aged twenty-five years, was shot with a 0.32 pistol ball about 3 P.M. September 14, 1901. The ball entered six inches below the left nipple and one inch to the left of the median line, and bled very little externally. Four and a half hours later pulse was 80, no sign of shock, no vomiting, but there was severe pain in the epigastrium and hiccough occasionally. Under chloroform, then ether, abdomen was opened through left rectus including the bullet hole. Considerable blood in abdominal cavity. Four holes in the jejunum, the nearest twelve inches from the stomach, were closed, also three openings in the mesentery. The ball evidently passed into the muscles of the back. Hot salt solution used to flush out abdominal cavity and wound was closed without drainage. There was suppuration in lower angle of the wound between skin and muscle. This finally healed. November 1st, one month and a half after injury, patient was up and able to walk by holding to objects. Skiagram taken showed ball located in angle between the spine and crest of ilium on left side and would have been removed when patient got stronger. On this day, November 1st, against advice he insisted on going home.

Soon after an abscess was opened in the back and the ball and a piece of cloth extracted. Death occurred November 22d, sixty-nine days after the operation.

Necropsy revealed general peritonitis, intestinal adhesions, and pus in the pelvic cavity. The wounds in the intestine had healed but could be seen. The abdominal cavity communicated with the abscess in the back and it was thought that this abscess had broken into the abdominal cavity.

Wound of Liver and Colon; no Operation; Recovery.

CASE VII.—P. J., negro, male, aged twenty-eight years, Virginia, was shot with a 0.38 or 0.41 pistol ball January 8, 1903. Little bleeding followed, but patient vomited two or three times. He was admitted to hospital two days later. The ball entered the right side over the lower border of the fifth rib, one inch to the inner side of and one inch below the right nipple, passing between the fifth and sixth ribs through the abdomen and lodging under the skin on the left side between the ninth and tenth ribs in the posterior axillary line, eight inches from the left nipple and eight and a half inches from the anterior superior spinous process of the ilium, where it was removed.

Patient's condition was good, a slight cough developed and a few rales could be heard at the base of the right lung; no expectoration of blood; he complained of the restricted diet. Pulse ranged from 84 to 116, temperature from 100° to 103°, once 104°. Next morn-

ing, January 23d, fifteen days after receipt of the wound, a fecal discharge was found on the dressing over the wound of exit. The fecal discharge continued until February 4th and ceased spontaneously, and patient was discharged recovered February 10th. The ball must have passed through the right lobe of the liver and the descending colon, and possibly opened the latter behind the peritoneum, so that the peritoneal cavity escaped infection.

Wound of Liver, Stomach, and Colon; Death from Hemorrhage.

CASE VIII.—M., negro, male, aged about thirty-five years, was shot about 1 o'clock A.M. May 27, 1903. Eight hours later he was suffering from nausea, vomiting, abdomen swollen and tympanitic, pulse 120, facial expression bad.

Under ether a bullet hole was seen one inch to the right and slightly above the ensiform cartilage; abdomen opened through right rectus. The ball had passed through the left lobe of the liver, the stomach from lesser to greater curvature near the pylorus, thence cutting a notch in the sigmoid flexure, opening it, after which the course of the ball was lost. The wounds, three in number, were closed with silk; there was much blood in the abdominal cavity; salt solution was used freely in the abdomen, but the patient died on the table, evidently of hemorrhage.

Wound of the Intestine; Two Perforations; Recovery.

CASE IX.—S. C., white male, aged sixteen [years, school-boy, accidently shot March 23, 1904, about 12.30 P.M. by a 0.22-calibre rifle. When seen at 3 P.M. pulse 120; axillary temperature 97°; he had vomited three times and had a good deal of pain in the abdomen. The ball had entered on the right side midway between the anterior superior spine of ilium and median line and about two and a half inches to right and below navel. Under ether the wound was carefully followed down by dissection (as probe would not go in) until the peritoneal cavity was found perforated, so it was opened freely. Considerable blood and clots (probably four ounces) found in pelvis. Two holes found in ileum about three-quarters of an inch apart and about twelve inches from the cæcum. Closed with mattress sutures, one row of silk. No extravasation of intestinal contents visible. Ball not found. Flushed with hot salt solution; abdomen closed without drainage. Recovery without incident.

Wound of Abdomen; Blank Cartridge; Death from Hemorrhage; Blood Vomited.

CASE X.—J. J. S., white male, aged fifty-eight years, policeman; was shot about 9 P.M. July 4, 1904. When seen by me about one hour later, at Georgetown University Hospital, there had been no

vomiting, but patient was weak and faint from loss of blood. The wound had been dressed with gauze to stop hemorrhage. Ether was given, but as patient took it badly—pulse 130 to 140, respiration rapid (he was a beer drinker)—chloroform was given and the wound was examined. It was a large, irregular wound, easily admitting the thumb down to the peritoneum, situated one and a quarter inches to the left of the navel and on the same level. It was enlarged by incision above and below and a small opening was then found in the peritoneum; the bleeding was from the rectus muscle. Still thinking I had a bullet wound to deal with, though surprised at the size and irregular shape of it, the peritoneum was opened and the viscera carefully examined. No blood in peritoneal cavity, no perforation of viscera; the only thing found was a contusion of the mesentery of a portion of the small intestine just beneath the wound. No ball or other missile could be found. Abdomen closed with gauze drain. That night patient vomited a large quantity of dark coffee-ground material. Next day he did the same thing and was a little delirious. This vomiting of dark blood continued daily, and during the night of the 6th he vomited a larger quantity than usual, his temperature fell to subnormal, pulse rose to 160, and death occurred at 7.15 A.M. July 7th, two and a half days after injury.

Necropsy by the coroner revealed no bullet or wad, no wound or injury of viscera except contusion and ecchymosis of a coil of small intestines. No sign of bleeding in the stomach.

Remarks. It is difficult to account for the source of bleeding which was evidently the cause of the patient's death, except on the theory that it came from the small intestines which had been contused. What caused the wound is also a mystery; whether it was the small pasteboard disk used to keep the powder in the shell or whether it was due to the explosive force of the powder is not known.

Wound of Intestine; Five Holes and a Laceration; Resection; Death from Hemorrhage.

CASE XI.—E. C., white male, aged fifteen years, shot himself accidentally with a 0.32-calibre pistol about 4 P.M. July 9, 1904. When seen two hours later his pulse was a little over 100 but exceedingly weak, face pale, pupils dilated, had vomited several times, and had severe pain in abdomen. There were pain and numbness in the right leg and foot. The ball had entered one inch to the left of the median line on a line drawn from the centre of the symphysis pubis to the anterior iliac spine; the wound was large, powder burnt, and blood flowed freely from it. Incision through left rectus, blood gushed from the abdominal cavity, and it was some time before the source of hemorrhage could be found. It was a large

branch of the superior mesenteric. The ball had made five openings in the bowel, cut the small intestine through half its circumference, and then cut the large artery mentioned. The mesenteric branch was ligated and eight inches of intestines opposite, which had been lacerated and contained two openings, were excised and the ends joined by suture. The three other holes were closed with one row of silk sutures for each opening. Resection was decided on chiefly because of the danger of gangrene from cutting off the blood supply which came from the large mesenteric vessel, which required ligation.

A. Wrinkling caused by suture of two holes. *B*. Perforation, showing small wound of entrance and enormous wound of exit at mesenteric attachment involving about half the circumference of the bowel.

The wounds were about the middle of the small intestine. Abdomen was irrigated with hot salt solution and closed without drainage. Patient vomited blood frequently during operation. Salt solution was used freely by hypodermoclysis and rectum, but death occurred next day at 2 P.M., about twenty hours after the operation, from exhaustion due to loss of blood. The ball was not seen; it had passed into the muscles of the back and probably wounded a cord of the sacral plexus. (See photograph of excised portion of intestine.)

Wound of Left Pleura, Diaphragm, Kidney, and Colon; Death from Hemorrhage.

CASE XII.—H. C. C., colored male, aged thirty-nine years, minister, was shot with a 0.32-calibre pistol about 11 o'clock P.M., September 8, 1904. When seen about fifteen and a half hours later he had a pulse of 90, temperature of 98.6°, anxious countenance, tympanitic abdomen. The ball had entered in the left anterior

axillary line over the eighth rib, passed between the eighth and ninth ribs, through the pleura and diaphragm, the splenic flexure of the colon, and the left kidney downward and backward. Just before the operation bloody urine was passed. Under ether the abdomen was opened through the left rectus muscle and a transverse incision to the left. Blood was found in the peritoneal cavity and behind the peritoneum extending from the left kidney downward to the sigmoid flexure of the colon.

One hole in the splenic flexure of the colon was sutured, no other could be found; one of the vasa brevia was bleeding freely and was ligated, and the wound in the kidney was closed with catgut continuous sutures. The abdomen was flushed out with hot salt solution and closed, leaving room for a gauze drain in the lower angle.

Operation was difficult, as patient was very fat. Death occurred twenty-four hours later as a result of loss of blood.

Wounds of Intestine by a Shot through the Pelvis; Eleven Holes; Death from Hemorrhage.

CASE XIII.—G. A. M., white male, aged twenty-four years; school teacher; was shot about 3 P.M. April 6, 1905. When seen at 8 P.M. his pulse was 150, but was imperceptible at the wrist; temperature in mouth 95.8°; he was perfectly conscious and calm and collected, but was thirsty and somewhat restless, pupils contracted (from morphine); he had some pain in bowels and had vomited once.

Salt solution, about 1000 c.c., was injected into the median basilic vein, and ether was given. The ball had entered one and a half to two inches below and behind the right anterior superior spinous process of the ilium, and a probe passed through the bone into the pelvis. Incision along the outer border of the right rectus muscle; a large quantity of dark fluid blood, probably 2000 c.c. (two quarts), was found in the abdominal cavity. This was washed out and the course of the ball traced. It entered the pelvis on the right side just below the external iliac vessels, passed through the rectum, through the sigmoid flexure, through several coils of small intestine, and entered the left wall of the pelvis almost exactly opposite its point of entrance, where it was lost. In its course it made eleven holes in the intestines: two in the rectum, two in the sigmoid flexure, and seven in the ileum; all were closed with silk sutures. No extravasation of intestinal contents was seen, but a fecal odor was perceptible. Abdomen was flushed out with several gallons of hot salt solution and closed without drainage. The patient's condition seemed better at the close of the operation than at the beginning.

Next morning temperature was to 99.6°, but pulse was 150, and during the day he was slightly delirious at times, and death occurred at 11 P.M., about twenty-six hours after the operation, from hemorrhage.

Wound of Liver and Intestines; Late Operation for Abscess; Recovery.

CASE XIV.—W. T., white male, aged forty years; was shot March 20, 1905, by a 0.22-calibre rifle. The ball entered the right side in the anterior axillary line about four inches below the right nipple, between the sixth and seventh ribs, and must have perforated the right lobe of the liver, as well as the intestines. When seen about one hour after the wounding he was suffering from shock, with weak pulse and cold extremities. He refused to submit to operation. Five hours later he vomited dark blood, and continued to do so at intervals of a few hours during the next four days. On the third night blood was passed by the bowels. The abdomen became distended and tympanitic, the pulse 110 to 120, the temperature 101° to 103°, and there was delirium. These continued for several days, then diarrhœa set in and continued for about ten days with six or seven passages daily. April 8th, nineteen days after the injury, the swelling of the abdomen had subsided sufficiently to outline a mass in the right lower quadrant of the abdomen. April 11th patient had twelve large stools, reddish in color, slimy and bloody, the mass in the abdomen almost disappeared, and the patient's general condition improved. Evidently the abscess had broken into the bowel. Three or four days later the temperature and pulse again rose and the mass in the abdomen became larger, so that on May 1st, forty-one days after the wound was received, it was decided to open it. This was done by an incision through the right rectus over the swelling. The abscess lay between the anterior abdominal wall and the intestines, which were strongly united by adhesions so as to shut in the abscess on all sides except below where an opening large enough to admit the finger communicated with the pelvis, from which considerable pus was removed by irrigation. The abdomen was closed, leaving a rubber tube extending into the pelvis. Pus was discharged through the tube for about a month, when the abscess cavity was allowed to close. In June patient developed a cough with mucopurulent expectoration, but in August, five months after the wound was received, he was in good health, evidently fully recovered from the wound.

COMPLETE AMPUTATION OF THE THIGH, WITH REPLANTATION.

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AND
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The idea of replanting an amputated limb was suggested by the results of the transplantation and replantation of organs. The urine secreted by a transplanted kidney on the third day after the operation contained most of the normal urinary constituents.[1] A thyroid gland, extirpated and replanted with reversal of the circulation and directly examined through a cutaneous incision on the twenty-fifth day after the operation, appeared to be in very good condition.[2] It was, therefore, supposed if an amputated limb were replanted, that its circulation and nutrition might be satisfactory. As there are great differences between a gland and a limb, it cannot be concluded from the fact that the former can be successfully transplanted that the latter can also. But there was no theoretical obstacle in the way of the success of the operation. Impelled by these considerations, several experiments were performed in order to study the technique and the results of the replantation of the thigh. Our experiments are yet in their preliminary stage. The only aim of the present paper is to show that a permanently successful replantation of an amputated thigh is perhaps possible.

I. Five experiments were performed. The first four were made on dead dogs and on dogs under ether, without aseptic technique. As the aim of these experiments was to develop an operative technique, it is unnecessary to give the details. The fifth experiment only will be described at length.

The operation was performed on about an 8-k. white dog, under ether. A circular incision of the skin was made immediately below the knee and the internal saphenous vein ligated. A second incision, perpendicular and continuous to the first one, was made along the femoral vessels as far as the upper part of Scarpa's triangle. The skin about the circular incision was dissected and retracted upward as far as the lower part of the thigh. The edges of the skin on either side of the longitudinal incision were dissected for about half an inch, the femoral aponeurosis exposed and opened, and the femoral vessels and nerve dissected and severed at the middle portion of the

[1] Carrel and Guthrie. Functions of a Transplanted Kidney. Science, October, 1905.
[2] Carrel and Guthrie. Extirpation and Replantation of the Thyroid Gland with Reversal of the Circulation. Science, October, 1905.

thigh. Section of the sartorius and femoral quadriceps was made about 3 cm. above the knee. Also section of the sciatic nerve and of the biceps, semitendinosus, internus rectus, adductor longus, and semimembranosus muscles was performed at different levels. Afterward the femur was cut at the union of its lower and middle thirds.

The limb was then removed and enveloped with sterilized moist compresses.

After a few minutes the amputated portion of the limb was placed on the operating table close to the remaining stump of the thigh.

The continuity of the artery and of the vein were immediately re-established by end-to-end suturing. The two ends of the bone were closely approximated and sutured together with a silver wire.

The temporary hæmostatic clamps were then removed and the circulation immediately restored through the peripheral parts of the artery and veins. Absolutely no blood escaped from the vessels at the lines of anastomoses. The pulsations of the popliteal artery immediately become normal and the femoral vein filled with circulating dark blood. The peripheral end of the cut muscles began to bleed slowly.

The cut ends of the sciatic nerve were then sutured together with silk, and the muscles, aponeurosis, and skin with catgut. The line of cutaneous sutures was covered by a dressing of gauze and collodion. Afterward the lower portion of the abdomen, the hip, the thigh, and the leg were enveloped with cotton and a large plaster-of-Paris bandage.

Before putting on the dressing the state of the circulation in the limb was examined. The pulsations of the popliteal and posterior tibial arteries were as strong as the pulsations of the same arteries in the other limb. The hue of the replanted foot was a little redder, and the temperature to the touch a little higher than were the hue and the temperature of the other foot and leg. The vasodilatation was similar to that observed following the use of an Esmarch bandage.

About Eight Hours after the Operation. The animal was in good condition. The replanted foot was much warmer than the normal one, and a little general swelling of the foot occurred.

Twenty-four Hours after the Operation. The animal was in good condition. But the replanted foot was very much warmer than the other foot. The swelling was considerable. There was no compression of the leg by the plaster-of-Paris bandage; therefore the swelling was thought to be due to the inactivity of the vasomotor nerves. During the afternoon the foot became a little cooler, but the swelling larger.

Thirty-three Hours after the Operation. The foot was found to be almost cold. The veins were greatly distended. A small incision was made between the toes. Dark blood and afterward red blood

escaped through the incision. The hemorrhage was then controlled and the wound dressed.

It was thought that a progressive obliteration of the venous anastomosis was taking place, owing probably to some lack of asepsis during the operation.

Fifty Hours after the Operation. The foot was cold and the swelling very large. No hemorrhage occurred through a small incision of the skin. As it was considered that the development of gangrene was unavoidable, the dog was killed with chloroform.

A postmortem examination was immediately performed, the results of which follow:

The plaster-of-Paris bandage and the cotton being removed, the gauze and collodion dressings over the lines of the cutaneous incisions were examined. The dressing of the longitudinal incision was good, but the dressing of the circular incision was strongly contracted, causing a ring of constriction around the leg, below which the skin was of a violet hue. The ring of constriction was located immediately below the knee. The foot and leg were cold and markedly œdematous, while the knee, the popliteal region, and the thigh were warm and not œdematous. No abnormal redness or swelling of the thigh could be detected.

The thigh and the leg were dissected, the sutures uniting the femoral aponeurosis cut, and the vessels examined. There was no stenosis of the artery or vein. The vessels were then opened by longitudinal incisions. The anastomoses were perfect, no clot being present, and the endothelium continuous and apparently normal.

The sutures of the muscles were cut and the ends separated. The examination revealed a satisfactory state of union between them. There were no dead spaces between the tissues, excepting a small one, near the bone. The hue of the peripheral end of the muscles was darker than of the central end. The connective tissue of the thigh and of the popliteal region seemed normal, while in the leg and foot below the ring of constriction it was markedly infiltrated and œdematous. The veins of the foot and leg were extremely dilated and filled with coagulated blood.

II. The failure of the operation was due only to a fault of technique. The circular constriction produced by the gauze collodion dressing had stopped the venous circulation, as it sometimes happens in human surgery when a dressing is too tightly applied—*e. g.*, in the dressing of fractures. At first there may be a feeble circulation through the constricted veins, but this soon stops and the limb becomes swollen. Shortly after the arterial circulation also stops and gangrene occurs.

Notwithstanding the fact that this experiment was unsuccessful, it furnishes important information regarding the phenomena following the replantation of a limb.

It shows that the circulation was easily and entirely re-established through the replanted thigh. The pulsations of the femoral, popliteal, and posterior tibial arteries were as strong as the pulsations of the corresponding arteries of the other side. The arterial circulation was seemingly normal.

The capillary circulation was exaggerated, the temperature of the limb being higher and its hue redder, owing doubtless to the fact that the vasomotor nerves were cut.

The venous circulation was observed to be good immediately after the operation. But the postmortem examination demonstrated that between the point of compression by the circular dressing and the anastomoses of the vessels there was neither infiltration nor œdema of the connective tissue. The hue, however, of the muscles peripheral to the line of amputation was darker than the hue of the muscles central to this line. This difference was probably due to venous congestion. The total area occupied by the veins in a limb is considerable. In the replanted limb all the dark blood contained in the veins peripheral to the line of amputation had to flow through the femoral vein. This would tend to increase the blood pressure in the peripheral veins of the limb, and therefore to cause congestion. This could largely be prevented by uniting the two ends of the internal saphenous vein.

The greatest departure from normal observed in the character of the circulation of the replanted limb was the dilatation of the smaller vessels. It is improbable that this vasodilatation of itself could have produced serious swelling of the limb. Doubtless the replanted limb increased in size owing to the vasodilatation, and this would have, of course, increased the tightness of the bandage. Examination of a transplanted kidney and of a replanted thyroid gland showed both to be enlarged in size, owing probably to the increase in the circulation.

At the present time it is not possible to foresee the changes that may occur in the nutrition of a replanted limb. It yet remains to be determined whether such a limb can long survive. It may be that the complete lack of central nervous connection will lead to the development of serious so-called trophic disturbances. Our experiment gave no information on this point, on account of its short duration. It might be assumed, however, that such lesions would not likely be of a very grave nature, as a thyroid, forty days after its replantation, was seen to be in very good condition. That argument, however, is of small value, experimental results only being adequate to settle such a point.

In order to secure these results two series of experiments will be completed.

The first of these consists of amputations and replantations, and the second of amputations and transplantations of limbs, of course, choosing animals of about the same size for the latter series. These

experiments should demonstrate the metabolic conditions in such limbs and the permanent results of the operations.

If these permanent results are possible, if no trophic troubles occur, and if the functions of the transplanted or replanted limb are satisfactory, then it will be legitimate to employ similar operations in human surgery. Of course it is a mere suggestion at present, and further investigation may show that it is quite impossible.

We are very glad to thank Dr. Stewart for giving us the privilege of performing these experiments in his laboratory.

TETANY: A REPORT OF NINE CASES.

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Escherich distinguishes two main clinical varieties of tetany. First, an *intermittent* form in which the muscular spasms disappear and only those latent symptoms associated with laryngospasm are present—*e. g.*, tetany of rickets. Secondly, a *persisting* form in which the contractures predominate and last for days or even for months. The irritability of the nervous system, however, is much less pronounced, so that latent symptoms may eventually be entirely absent. This latter group also includes the affections: (*a*) *flexibilitas cerea*, where the entire body is in a state of tonic, wax-like rigidity; (*b*) *arthrogryposis*, where the hands and feet only are affected; (*c*) *pseudotetanus*, in which the trunk and legs are affected.

Most authorities are now agreed that "carpopedal" spasm and "laryngismus stridulus" are manifestations of tetany in children.

Following Frankl-Hochwart's classification, we have grouped our cases into: 1. Tetany of gastric origin, of which we have six examples. 2. Tetany of intestinal origin, of which we have but one example. 3. Tetany of childhood, of which we report two illustrations. With one exception (Case V) we have not included cases from the Medical Dispensary. A case of tetany complicating pregnancy, which was in the wards, has been reported at length by Dr. H. M. Thomas[25] and will be only referred to here. One other case, diagnosed as tetany, has been purposely omitted, as the presence of a marked hysterical element and the absence of the secondary phenomena do not warrant its inclusion in this paper.

Case I. *Gastric ulcer* (?); *hyperacidity; hypersecretion; tetany.*

C. K., aged forty-six years; male; white; German; laborer. Hospital No. 36910. Admitted November 8, 1901. Complaint, stomach trouble.

Family History. Negative.

Previous History. He had stomach trouble for thirteen years. He denied venereal disease. He had drunk one to two quarts of beer a day for the past fifteen years.

Present illness began one year ago, November 1, 1900, with severe burning pain in the stomach, which was continuous night and day and was not affected by food. He vomited after meals nearly every day. In January, 1901, while at stool, he vomited almost a bucketful of blood. Hæmatemesis did not recur. He had lived on milk and eggs and small amounts of wheat bread since March, 1901.

Physical examination was negative. On November 11th he vomited large quantities of very acid clear mucoid material. At the end of the vomiting there was spasm of the muscles of the hands and feet and slight spasm of the muscles of the trunk. He was conscious, but was emotional. Following the removal of the test breakfast he had a similar, much less marked attack. Gastric analysis showed total acidity 70, total free HCl 65, and absence of lactic acid. Microscopic examination was negative. The passage of the stomach tube during the intervals of digestion revealed large quantities of clear material, showing marked hyperacidity on several occasions. The temperature ran a normal course. Pulse ranged from 76 to 112.

On November 28th the patient was discharged, his weight on discharge being 197½ pounds.

He was readmitted on February 24, 1902, for "stomach trouble."

His second illness began on February 15, 1902, when, after working a short time he began to vomit repeatedly until February 20th, since when he had only vomited once. He had two attacks of tetany during the paroxysms of vomiting, one on February 20th, confined to the hands, during which he was unable to straighten his fingers. On this date he had to stop work from weakness. Weight on this admission 177 pounds.

Physical examination was negative, except for the presence of fairly numerous sonorous piping rales throughout both lungs, and the area of gastric tympany was considerably increased. The facial and Trousseau's phenomena were negative. Red blood corpuscles, 5,516,000; white blood corpuscles, 9000; hæmoglobin, 95 per cent.

On February 25th he had a violent vomiting attack, followed by a paroxysm of tetany of the upper and lower extremities, and facial muscles, and the platysma. During the attack, which lasted seven to nine minutes, he complained of great pain in the abdomen. Following this the patient looked ill, the tongue was coated and the breath foul, but the area of gastric tympany seemed normal. An analysis of the vomitus showed a total acidity of 94 and a total free HCl of 74.

On February 28th a great irritability to the galvanic current was

noted. With the cathode over the ulnar nerve tetany was induced with a very feeble current of about 3 milliampères.

The urine examination was always negative. The temperature curve ranged from 97° to 100° and the pulse, which reached 120 during the day of the attack, usually ranged from 76 to 100. During his stay in the hospital he was in a curious nervous state, being very emotional, excitable, and difficult to control. Somewhat improved, and weighing 175 pounds, he insisted upon going home on March 5, 1902.

The patient returned in March, 1905, in answer to a letter. He had been free for three years from all the symptoms of both tetany and hypersecretion. He had regulated his bowels and was in perfect health.

CASE II. *Dilatation of the stomach; tetany.*

E. C. B., aged twenty-four years; male; white; German. Occupation, rattanner. Hospital No. 37166. Admitted December 4, 1901. Complaints: "indigestion and cramps in the hands."

Family History. Negative.

Previous History. Negative except that for four weeks in the summer of 1900 he had pain after eating, which was relieved by medicines.

Present illness began in July, 1901, with pain after eating and occasional diarrhœa, which continued up to his admission. On November 20th he had the first attack of cramps in the hands and feet preceded by a tickling sensation in the legs from the knees to the feet. The hands were stiff and straight. After this attack he had five or six others. He stopped work in June, and remained in bed all August and September. On December 3d he had the severest attack and was brought to the Medical Dispensary. In this attack his hands were "drawn up" for the first time. The pain in the stomach gradually improved. There had been no nausea and no vomiting. He had on an average two to four movements a day. He had lost thirty pounds in weight.

Upon *physical examination* the patient was emaciated, sallow, and looked ill. The gums were pale; the tongue was lightly coated. The pupils were equal and active. The area of gastric tympany was considerably increased, without inflation reaching to the fourth intercostal space in the midaxilla, measuring 24 by 18 cm. After inflation the greater curvature extended well below the umbilicus. There was no visible peristalsis and no palpable mass. There was marked mechanical and electric irritability of both hands and feet—Trousseau's phenomenon being elicited by compression of either the brachial or femoral artery. On pinching the biceps a tetanic contraction lasting several seconds was induced. With a galvanic current of 2 milliampères there was a typical spasm of the hands when the brachial plexus was stimulated; a current of 6 milliampères to the brachial plexus caused a spasm of both the legs

and the arms. There was spasm of the facial muscles on weak stimulation of the seventh nerve. A very weak faradic current produced a general tetany of the arms and legs. Red blood corpuscles, 2,460,000; white blood curpuscles, 3600; hæmoglobin, 50 per cent.

On December 9th Dr. Thomas noted that the hands were free from spasm, and that there was slight fibrillary tremor in the intrinsic muscles of the hands. Strong muscular effort, however, caused spasm; and the facial and Trousseau's phenomena were both perfect.

On December 7th a test breakfast showed a residue of 110 c.c., a total acidity of 56, and free HCl 21. Microscopic examination was negative.

On December 10th during gastric lavage the patient had a general spasm, involving the face muscles as well.

The urine examination showed on two occasions a faint trace of albumin. The temperature ran a normal course. The pulse was 88 to 92 to the minute. His weight on December 9th was 101¾ pounds. On December 10, 1901, he was discharged at his own request, unimproved.

His physician, Dr. John Girdwood, reported that after the patient had left the hospital the facial phenomenon continued for a long time. The tetanic spasm recurred in June, 1902, though in a milder form. The gastric pain, nausea, and vomiting also recurred periodically. He became unable to retain solid food; anæmia became more pronounced, and he died on April 17, 1903, eighteen months after his discharge.

CASE III. *Dilatation of the stomach; hyperacidity; tetany.*

G. W. S., aged fifty-two years; male; white; American; occupation, manager of foundry. Hospital No. 43203. Admitted June 27, 1903. Complaint: "pain in the back of the neck and sides; stomach trouble."

Family History. Negative.

Previous History. Negative.

Present Illness. For the past ten years he had been feeling out of sorts, with a dull, frontal headache and pain in the eyes, a bad taste in the mouth, loss of appetite, and constipation. There had been occasionally slight pain in the stomach. He had not vomited except with "car-sickness," to which he was very liable. He had some belching of gas, but no hæmatemesis.

Physical examination revealed some emaciation. There was no enlargement of the thyroid gland. The heart and lungs were clear throughout. The abdomen appeared natural except for marked clapotage. After inflation of the stomach the abdomen became prominent from the midepigastrium to the umbilicus. There was slight visible peristalsis. The area of tympany measured 23 by 17 cm. and extended upward to the seventh rib in the midaxilla, and

to the right as far as the mammary line. No masses were felt. The knee-jerks were normal.

On July 1st the test breakfast revealed a total acidity of 66; total free HCl 54. Only 30 c.c. were removed. Microscopic examination was negative. At the end of the lavage the patient felt faint, looked pale, and had to be supported. Suddenly both arms began to twitch and were brought across the chest, overlapping each other. The hands were flexed at the wrist, with the fingers flexed at the proximal joints and extended at the distal. The attack lasted only a few seconds. The feet were not observed.

The urine examination showed a faint trace of albumin on two occasions. The temperature ran a normal course. The pulse ranged from 60 to 84 a minute. He was discharged improved on July 1, 1903.

CASE IV. *Pyloric stenosis; dilatation of the stomach; tetany; death; autopsy.*

D. K. N., aged fifty-eight years; male; white; American. Hospital No. 49558. Admitted January 15, 1905. Complaint: "stomach trouble."

Family History. Negative.

Previous History. In his youth he had pain in the region of the navel with vomiting, which afforded relief to the pain. There had never been hæmatemesis or jaundice. In 1890 he had an attack of Bell's paralysis on the left side of the face, following exposure to a draught.

Present illness began four or five years ago, with a sour stomach after meals. He would induce vomiting with almost immediate relief. The vomitus was large in amount, but never contained any blood. He began to use the stomach tube three years ago, since which he had used it regularly every night, removing very large quantities of sour, undigested food. Before he began the use of the stomach tube he had several attacks of cramps "all over the body." These, which he termed "congestive chills," were exceedingly agonizing in character, but were never accompanied by fever or jaundice. In illustrating the attacks he imitated exactly the "obstetrical hand." During one such attack he was thought by his physician to be dying. In none had he lost consciousness. Since beginning the use of the stomach tube he had never had an attack. He gradually lost 25 pounds in weight. In November, 1904, he consulted Dr. Osler, who made a diagnosis of pyloric stenosis, and recommended surgical treatment.

Physical examination was negative except for the abdomen. The latter presented a remarkable picture, with marked prominence in the middle zone, especially just to the right of the navel. The epigastrium was hollowed out. Quite large waves of peristalsis were seen passing from left to right, most marked in the umbilical region. No definite mass was made out, though on one examination

the pylorus was thought to be felt. The stomach lay obliquely in the abdomen and measured about 14 by 34 cm. on percussion. There was marked clapotage. After inflation the waves of peristalsis were a little more active, and the area of gastric tympany measured 15 by 36 cm.

Upon the passage of the stomach tube four hours after the evening meal, 1500 c.c. of residue were withdrawn. This on standing separated into three layers: a frothy upper, a middle liquid, and a lower solid layer. The odor was sweetish, and suggested fermentation. Free HCl was present, but lactic acid was absent. On microscopic examination large numbers of sarcinæ were found. A test breakfast after a gastric lavage the previous night, revealed a total amount of 460 c.c., a total acidity of 40; free HCl 10. Microscopic examination was negative, except for numerous sarcinæ, yeast cells, starch, and an occasional red cell.

He did very well for a few days and was allowed to move about at will. On the morning of January 21st the patient complained of some discomfort in the stomach and numbness in his hands. During the day of the 22d he used the stomach tube, with temporary relief. During the night of the 22d he was awakened by discomfort in his stomach and he again used the tube. Immediately after the lavage he complained of a severe pain in all the extremities, and he awakened the ward with his shrieks. At 2.15 A.M. (fifteen minutes after the onset) the patient was seen by me in a most pronounced tetanic spasm of the upper and lower extremities, as well as of the facial muscles. The spasm was most marked in the right side of the face. All the muscles of the extremities were rigidly contracted, with the appearance of the typical obstetrical hand and carpopedal spasm. The neck and trunk muscles seemed uninvolved. The pulse was rapid; the heart beat violently; the face was bathed in sweat; there was little or no dyspnœa. While the spasm was constant, at repeated intervals it became more intense and the patient would shriek with pain in spite of opiates. There were suppression of urine, clouding of the mind, marked cyanosis of the face, especially of the tongue and a very marked condition of mechanical irritability. The slightest pressure over the nerve or the artery increased the condition. There was slight twitching of the muscles of the face and the upper extremities. The blood count on the 23d revealed: red blood corpuscles, 4,056,000; white blood corpuscles, 17,480; hæmoglobin, 70 per cent. During the 23d his condition gradually grew worse. The muscular irritability became extreme. The slightest touch to the abdomen or the extremities, or even knocking against the bed, or the administration of the medicines was sufficient to throw the patient into a marked spasm. The pulse became very poor and there was difficulty in swallowing. Active sweating was induced by hot packs. Large amounts of normal salt solution were given subcutaneously and per rectum. The stomach was washed out repeatedly with bicarbonate

of soda, and the patient was well purged. At about 8.30 P.M. of the same date the condition seemed somewhat improved; the respirations were slower, 20 to the minute; pulse rather rapid, and temperature 99.5°. The patient died suddenly at 9.30 P.M.

The urinalysis always revealed a clear urine, a specific gravity of 1015 to 1017, a faintly acid reaction, no sugar, a moderate amount of albumin, no casts.

At the autopsy, performed by Dr. W. G. MacCallum, the following condition was found: The rigor mortis had fixed the extremities in the tetanic position. The lungs showed a beginning bronchopneumonia. The heart was practically normal. On opening the abdomen a most extraordinary picture was presented. A very large, enormously dilated stomach lay obliquely across the abdomen, reaching far into the right flank, but not as low down as appeared on the early clinical examination. There were rather firm adhesions between the pylorus and gall-bladder. The pylorus itself was embedded in a firm scar the appearance of which suggested a healed ulcer. The orifice was very small, barely admitting the point of a probe, and was in marked contrast to the pyloric end of the stomach on the one side and the duodenum on the other. The latter was probably also dilated. Examination of the kidneys revealed a chronic diffuse nephritis.

CASE V. *Hyperacidity; dilatation of the stomach* (?); *tetany.*

P. A., aged eighteen years; male; colored. Occupation, janitor. Dispensary No. 71856. Admitted February 20, 1905.[1] He complained of "cramps in the muscles of the shoulders and hands coming from the stomach."

Family History. Negative.

Previous History. Negative.

Present illness began February 2, 1904, with a tingling in the hands, followed by a "drawing up" of the hands and the legs. He tried to walk, but was unable to do so. The condition passed off in about an hour, but recurred in the afternoon and that night, when he had a severe attack associated with very little pain, his hands and feet being both involved, with "contraction of the throat." He states that he lost consciousness and that he was out of his head for several days afterward. Except for indigestion and gaseous eructations he remained well until December, 1904, when, after an error in diet, he had an attack of vomiting and a spasm similar to the one above described. The spasms recurred in January, and again on February 17 and 20, 1905. While waiting for examination he had an attack of cramps in the arms, following which he was very restless, walking to and fro.

Physical examination revealed an intelligent colored youth of good physical condition. There was no speech disturbance. Tapping

[1] This case was kindly sent me by Dr. Thomas from his Nervous Clinic in the Johns Hopkins Hospital University.

over the facial nerve caused contraction of the muscles, associated with a sensation like a pin-prick. A typical Trousseau phenomenon was elicited. With a current of about half a milliampère cathode closure caused a contraction of the arm muscles. If the cathode were placed on any nerve and the current gradually increased, without make or break, the muscles supplied by the nerves were thrown into tetanus. The same condition could be brought out in the face. The knee-kicks were normal. There was no apparent enlargement of the thyroid gland.

On February 23d he returned for examination. On the previous Tuesday and Wednesday night he was awakened repeatedly by tetanic spasm. He had a tingling sensation over the sacrum and shoulders, and, during the attacks, difficulty in micturition, dizziness, vertigo, and pallor. He was very constipated. On examination the facial phenomenon was still present. Pressure over the nerve in the upper arm caused tingling and numbness in the hand, but no spasm. Blood pressure in the left brachial artery was 143 mm.

I first saw the patient on February 25, 1905. A typical history of hypersecretion was then elicited and he was advised to have a test meal. On February 26th he was given an Ewald breakfast, and after one hour 100 c.c. were expressed. The sediment was large in amount, contained no mucus and no blood. Total acidity was 95; total free HCl 71; there was no lactic acid. The microscopic examination was negative, except for some starch and yeast cells. The area of gastric tympany before inflation seemed a trifle increased, reaching just below the navel in the median line, and measuring 27 by 14 cm.; after inflation it did not alter appreciably. There was no visible peristalsis and no palpable tumor.

When last seen the patient had been free from the attacks of tetany for some time.

CASE VI. *Dilatation of stomach; tetany.*

F. K., aged forty-five years; male; white; Irish. Occupation, plumber. Hospital No. 50101. Admitted March 3, 1905. Complaint: "spasms."

Family History. Negative.

Previous History. He had been a large eater and had had indigestion for years. He was habitually constipated. For years he had been a very heavy drinker of beer and whiskey.

Present Illness. On February 11, 1905, he stepped on a nail; next morning his foot was swollen and remained so for four days, but by the end of a week it was perfectly well. On February 19, 1905, he had numbness and a sleeping sensation in his hands, arms, and feet. This gradually got worse and became so marked that he constantly rubbed them for relief. On March 3d at 6 A.M. he first noticed "drawing up" of the fingers of both hands, but more especially of the left. The hands were flexed at the wrist and the forearms at the elbows. This spasm lasted until 9 A.M. At 10 A.M.

he had a second attack, which was more severe, but limited to the left arm; the right arm and both legs were numb. This lasted until 1 P.M. At 5.30 P.M. a third attack occurred, affecting both arms; there was no cramp in the legs, but the face felt numb and the mouth drawn. The pain was very severe in all these attacks, causing him to cry out. Fearing lockjaw he came to the hospital and was admitted at 11 P.M. on March 3d.

Physical Examination. In the waiting-room he was very excited, and in great fear of another attack. There was no trismus or spasm of the muscles of the extremities. There was a well-marked Trousseau symptom in both arms, especially marked on the left side. He cried with pain. There was no Chvostek sign present.

Next morning when I saw him there was no spasm of the muscles and neither Trousseau's nor Chvostek's symptom could be elicited. The tendon reflexes of the upper and lower extremities were diminished. There was no lead-line on the gums. The lungs and heart were normal except for an accentuation of the aortic second sound. The radial artery was palpable. The area of gastric tympany without inflation was moderately increased. A blood count showed: red blood corpuscles, 4,536,000; white blood corpuscles, 5140; hæmoglobin, 83 per cent.

On March 9th an Ewald test breakfast gave a residue of 120 c.c., a total acidity of 30, and free HCl 19. Microscopically, it was negative. On this date the area of gastric tympany after inflation extended 4 cm. below the navel in the median line and measured 31 by 14 cm. There was no peristalsis visible. The electric reaction of the ulnar nerves was normal.

The urine contained on one examination a trace of albumin, but no casts. There was slight fever during the first twenty-four hours (101°).

He was discharged well on March 9th, having had no attack while in the hospital.

On May 13th he returned for observation with his physician, Dr. John Girdwood. He had been drinking heavily since his discharge and had had frequent attacks of pain in the stomach with vomiting. He had had numerous attacks of "cramps" in the arms, and Trousseau's sign had been elicited by Dr. Girdwood on several occasions since discharge. At a subsequent visit there were no muscular cramps, and I could obtain neither Trousseau's nor Chvostek's sign.

CASE VII. *Chronic diarrhœa; tetany.*

R. J., aged twenty-four years; male; white. Occupation, lumber inspector. Hospital No. 42003. Admitted March 7, 1903. Complaint, diarrhœa.

Family History. Negative.

Previous History. In 1895 he received a gunshot wound in the left forehead with the "loss of two ounces of brain substance." He

was unconscious for two weeks, during which time he had convulsions. No paralysis followed, but for two or three months he had sensory aphasia. In the summer of 1901 he became subject to dizzy attacks. Average weight, 180 pounds.

Present Illness. Since December, 1902, he had "cramps." The first attack came on as a tingling in the fingers of the left hand as though they were asleep. Then the hand became cramped, with contraction of the flexor muscles and doubling up of the fingers and wrist. In later attacks the cramps sometimes extended to the other arm and even to the feet, calves, and thighs. The legs, however, were not so often attacked as the arms. "Sleepy sensations" had been noticed in the abdomen and chest. In February, 1903, he had his first convulsion, about which he remembered little; he had been told that his face was twisted and that he foamed at the mouth. He had had two or three convulsions since that date. His memory had been poor since the convulsions began. Diarrhœa began in May, 1902, while working in New Orleans and drinking river water. The stools numbered eight a day, were watery, dark in color, but never contained mucus or blood. The appetite had failed somewhat during the few weeks before his admission.

Physical Examination. There was some emaciation (weight 101½ pounds). There was a scar over the left forehead. The left pupil was smaller than the right, but both reacted to light. There was no paralysis of the seventh nerve. There was general muscular atrophy, especially marked in the interossei. There was very slight clubbing of the fingers. Speech was slow and drawling, but not scanning. The thyroid gland was not enlarged. The heart and lungs were normal. The abdomen was somewhat distended, with some general resistance on palpation. The area of gastric tympany was somewhat increased. The knee-jerks were sluggish. The stools were negative for parasites or their eggs. Red blood corpuscles, 4,604,000; white blood corpuscles, 8900; hæmoglobin, 78 per cent. Blood pressure, 120 mm. Hg.

The special examination revealed some constant flexor contraction of the hands and feet. Trousseau's phenomenon was readily elicited in both hands and feet. The facial phenomenon was also present. Dr. H. M. Thomas found marked increase of the electric irritability to galvanism; thus with the cathode pole on any nerve trunk and the current gradually increased from zero, without make or break, the muscles supplied by the nerve were thrown into tetanic contraction. This was tested on March 10th and again on March 23d, when a somewhat stronger current was necessary; thus

		March 10th.	March 23d.
Right ulnar	K. C. C.	= 0.8 milliampère.	= 0.7 milliampère.
	A. C. C.	= 3.0 "	= 1.7 "
	A. O. C.	= 3.0 "	= 4.0 "
	K. C. Te.	= 1.0+ "	= 2.0 "

For the first week after his admission there was constantly more or less flexor contraction, with occasional active spasm in the early morning. These by March 16th were much less marked, and the tetany by pressure over the nerve trunks was much less easily induced, less marked in degree, and accompanied by less discomfort. The facial phenomenon varied. The patient's general condition gradually improved, and the diarrhœa ceased entirely by April 1st.

On the night of April 9th the patient was heard to cry out in a peculiar gurgling fashion, and was found in a general convulsion, the eyes rolling, the teeth grinding, the lips contracted, and he was foaming at the mouth. The head was thrown back, and all the limbs were drawn up in a general tetanic spasm, which was quite symmetrical, and lasted one minute. There was no relaxation of the sphincters. After the convulsion he was drowsy and stupid, complaining of headache. Next morning there was some flexion of both hands, and tetanic spasm was readily elicited. A blood count on April 13th revealed: red blood corpuscles 5,165,000; white blood corpuscles, 9000; hæmoglobin, 94 per cent. Gastric analysis on April 21st yielded a residue of 150 c.c., thick and mucoid. The microscopic examination was negative for bacilli and sarcinæ. There was no free HCl and no lactic acid; total acidity, 6.

A note on May 11th stated that he still had from two to four semisolid or formed stools in the twenty-four hours. Trousseau's phenomenon could still be elicited after three or four minutes' pressure. The gastric analysis on May 11th and 13th again revealed marked subacidity.

The urine examination revealed a specific gravity of 1004 to 1013, no sugar, an occasional trace of albumin, but no casts except at the first examination.

The temperature ran a normal course, with but a slight rise on April 30th. His condition gradually improved, he had no further convulsions, and he was discharged well on June 29th, having gained 27 pounds.

A letter from him dated March 23, 1905, stated that he had been free from both diarrhœa and tetany since his discharge and that he felt perfectly well.

CASE VIII. *Tetany; rickets* (?).

R. C. L., aged six months; male; colored. Hospital No. 45548. Admitted February 4, 1904. The history was obtained from the mother. Complaint: "spasms."

Family History. Negative.

Previous History. He was a healthy baby, having been fed on mother's milk until two weeks before admission, when he was given equal parts of boiled cows' milk and water. The bowels were regular.

Present Illness. The child began to fail two weeks before admission. On January 28th the spasms were first noted. They

recurred frequently, there being five on each night of February 2d, 3d, and 6th. The first indication was rolling up of the eyes, then rigidity of all the muscles, with jerking of the hands, and twitching of the legs and the left half of the face. The duration of the spasms was usually half an hour. The child did not cry, but he had incontinence of urine during the seizure. After the spasms he would doze. There had been no vomiting. The bowels had been constipated. There was general muscular tenderness upon handling. The recent spasms were not of such long duration, but were more frequent. There was cough and some loss in weight. On January 29th the diet was regulated, and the bowels freely purged without benefit.

Physical examination revealed a well-nourished though dull and drowsy child. The fontanelles were open. Child was somewhat rachitic. There was dull tympany and tubular breathing over the upper lobe of the right lung. The heart and the abdomen were negative. The arms were rigid and there was fairly marked carpopedal spasm. The knee-jerks were exaggerated. Red blood corpuscles, 4,900,000; white blood corpuscles, 11,600; hæmoglobin, 75 per cent. The differential count was normal.

On February 10th the child was fretful. There had been no convulsions for four days. There was still quite marked tetany of the hands and feet.

On March 7th there was little or no improvement. There was slight rigidity of the neck muscles and some spasm of the hands and feet. Lungs were clear. The eye-grounds were negative. White blood corpuscles, 6300.

On March 11th a lumbar puncture revealed a clear fluid under a pressure of 100 mm. The cultures were negative.

On March 19th the child was removed against advice. There was still marked carpopedal spasm and rigidity of the legs and neck. The hands, though almost constantly contracted and rigid, were occasionally relaxed. During his stay in the hospital there had been slight fever (100°) for three or four days. The pulse ranged from 100 to 120. Respirations were 28. His weight on admission was 14 pounds; on discharge, 12 pounds. He had been taking parathyroid gland for several days before his discharge.

CASE IX. *Gastroenteritis; abscess of the scalp; rickets; tetany.*

A. R., aged three and a half months; female; colored. Hospital No. 46788. Admitted May 19, 1904. The history was obtained from the mother. Complaint: "fast breathing."

Family History. Negative.

Previous History. The patient was born with the aid of forceps. She was breast-fed for one month until she began to suffer from vomiting. She was then fed on oatmeal-water and condensed milk and the digestive trouble ceased. The bowels were regular. She had no infections other than thrush.

Present illness began May 16th with fretfulness followed by repeated vomiting. On May 18th there was an attack in which the eyes rolled back and the head tossed from side to side. There was no general convulsion. This attack was followed in three to four hours by rapid breathing and a slight cough. The bowels were loose (three to four stools in twenty-four hours).

Physical Examination. The child looked ill. Respirations, 70 to 80 to the minute. There were a few small pustules on the neck and left arm. There was a small ulcer with a sharp edge over the right shin. There was also decided evidence of rickets. The thoracic and abdominal viscera were normal. There was flexion of the arms and wrists, with the fingers clenched over the thumbs. There was also carpopedal spasm and slight retraction of the head and rigidity of the neck. The tendon reflexes were normal. Red blood corpuscles, 4,700,000; white blood corpuscles, 8600; hæmoglobin, 50 per cent.

The child improved slightly, but showed evidence of intestinal colic, with frothy, light-green stools, varying in number from two to seven in the twenty-four hours.

On May 27th the temperature, which had been normal, rose rapidly and ranged from 102° to 103°.

On May 30th an abscess of the scalp was found over the mastoid region (white blood corpuscles, 6600). The child was then transferred to the surgical service, where the abscess was evacuated and drained, but no sign of involvement of the underlying bone found.

The child did well for some time and the abscess gradually healed. About the middle of June the eyelids, feet, and shins became œdematous, and the urine was found to contain a trace of albumin, but no casts. There was no note as to the presence of tetany after May 30th. The child died July 7th from asthenia. The autopsy revealed no evidences of meningitis or nephritis.

SUMMARY OF THE AUTHOR'S CASES. Seven cases were in adults, whose ages ranged from eighteen to fifty-eight years, or an average of 38.8 years. These were all males, though the ratio of the admissions to the medical service is two males to one female. There were but 2 cases in children (both six months or under); but it must be borne in mind that these figures give no accurate idea of the frequency of infantile tetany in Baltimore, as the latter, though not infrequent in the pediatric and neurological dispensaries, are rarely admitted to the wards.

The occupation of the adults was very varied, and in only one was it of a specially sedentary nature. They were one laborer, one rattanner, one janitor, one plumber, one manager of a foundry, one lumber inspector, and one merchant.

Four of them had definite dilatation of the stomach, in one case due to pyloric stenosis.

Two others had hyperacidity of the gastric juice without evident

dilatation of the stomach. Hence there were 6 cases of gastric origin.

One case had chronic diarrhœa, which is the only adult case of tetany of purely intestinal origin in the American literature of the past decade.

In the infantile cases, one had slight evidence of rickets and the other had undoubted signs of rickets, as well as an abscess of the scalp and an acute gastroenteritis.

All the seven adults had definite prodromata, while in all the series there was the typical spasm of the muscles, either of the upper extremities alone (2 cases) or of all four extremities (7 cases). In addition, the face was involved in 4 cases, the neck in 2, and the trunk in 1 case. The intensity of the paroxysm was severe in 4, moderate in 3, and mild in 2 cases. The duration of the muscular spasm itself, or the liability thereto, ranged from a few seconds to three months.

The four accessory phenomena were unfortunately not tested in either of the infantile cases or in all of the adult cases. Trousseau's phenomenon was present in 5 of 6 cases examined. Chvostek's sign was positive in 4 of 6 cases tested. Erb's phenomenon was demonstrated in 4 of the 5 cases in which the electric examination was made. Hoffmann's phenomenon was looked for in only 1 case and then without success.

Pain in the affected muscles was a marked feature in 3 cases. In 1 gastric case severe abdominal pain was experienced.

Of the rarer manifestations, fibrillary tremor in the muscles of the hands occurred once; coarse twitchings of the muscles of the arms, once; general epileptic convulsions, delirium, coma, dysuria, anuria, and dysphagia, each in 1 case. In the case of intestinal origin there was clubbing of the fingers.

The tendon reflexes were normal in 3, exaggerated in 2, and diminished in 3 cases. In 1 case they were not tested.

The temperature was normal in 5 cases and slightly elevated in 2. In another case the temperature reached 101°.

The pulse rate was a little above normal in 5 cases, sometimes ranging as high as 100 or more beats a minute.

The urine showed the presence of albumin in 6 of the 7 cases in which this was tested. Casts were found in none. In 1 case the autopsy revealed the presence of a chronic nephritis.

The bowels were loose in 3, constipated in 4, and regular in 2 cases.

The examination of the hæmoglobin and red cells showed a normal count in 2, slight anæmia in 2, and a marked secondary anæmia (50 per cent.) in 1 case.

The leukocytes were normal in 5 cases and increased in 2. In one of the latter the leukocytosis amounted to 17,480 per c.mm., due possibly to the marked stagnation of the gastric contents,

though, as there had been no count made before the onset of the tetanic spasm, it is impossible to say absolutely.

An analysis of the gastric contents showed the constituents to be normal in 2 and subnormal in 1 case. In 3 there was hyperacidity.

Four cases recovered completely; 3 were discharged unimproved, of which 1 died eight months later from asthma; 1 was lost sight of, and 1 is still subject to tetanic cramps. Two died in the hospital, one during the attack of tetany and the other from asthma due to an abscess of the scalp.

All 9 cases received medical treatment.

Let us now briefly discuss the more general features of tetany.

ETIOLOGY. *Historical.* To Dance (1831) and his pupils of the French school is due the earliest and, indeed, the greater part of our knowledge of the disease. Frankl-Hochwart claims that Steinheim, a physician of Altona, gave the first clear description of tetany in 1830 in a short paper entitled "Two Rare Forms of Severe Rheumatism." Lucien Corvisart, in 1852, proposed the name of "tétanie." Trousseau, in 1854, made the most important contribution to the recognition of the disease. Since 1872 the Germans have contributed most to our knowledge.

Incidence. More cases have been reported from Europe than any other continent. In Vienna tetany formed 0.7 per cent. and in Berlin 0.1 per cent. of the neurological clinic. In America it is rare. Griffith[10] was able to collect but 77 cases in American literature up to January 1, 1895. From that date to January 1, 1905, I have found only 23 additional cases in adults and 45 in children. This brings the total of American cases, including our 9, to 154. A glance at the appended tables of reported cases will reveal the more important data of these. We have omitted from this list 23 other cases by reason of the incompleteness of the data, or the probable unsuitability of the diagnosis. Among 18,150 admissions to the medical wards of the Johns Hopkins Hospital there have been but 9 cases of tetany, or 0.05 per cent. Tetany is commonest in winter and spring, especially the months of March and April. Exposure to cold during these months may determine the outbreak of the latent disease.

Age. It is a disease chiefly of infant and young adult life; 60 per cent. occur before the twentieth year. My tables confirm this statement.

Sex. In infancy the male seems more susceptible. Thus, of our 47 cases there were 33 males (70 per cent.). After the twentieth year it is held that the female is more susceptible. In my figures for adults, however, the same proportion as in infancy holds good.

Heredity. There does seem to be a peculiar liability in some families to the disease. Vaughn[27] reported, in 1893, 5 cases in one family in New York. In 5 of the infantile cases in my tables (Cases

3, 5, 21, 24, and 45) another member of the family had been affected.

Occupation. Tetany seems more common in the working classes, especially in those pursuing a sedentary occupation. Of 399 cases collected by Frankl-Hochwart, 174 were shoemakers and 95 in tailors. In certain German towns where shoemakers comprise but 1.3 per cent. of the population, 43 per cent. of all the cases were of this class. Unfortunately, the occupation of many of the reported cases was not given, for which reason I have not attempted to report figures on this point.

Etiological Classification. The various conditions with which tetany is associated is best shown by Frankl-Hochwart's classification, which I have adopted. Yet I agree with Strong's[24] statement that they are groups of convenience, representing frequency of occurrence, which will be ultimately replaced by divisions expressing the etiology.

A. Tetany of Adults. 1. In the first group our authority places the *epidemic tetany* or "idiopathic workman's tetany," or, as more commonly known, "shoemakers' cramp." "In certain parts of the continent of Europe the disease has prevailed widely, particularly in the winter months. Von Jaksch, who has described an epidemic form occurring in young men of the working classes, sometimes with slight fever, regards the disease as infectious. This form is acute, lasting only two or three weeks and rarely proving fatal." (Osler.) Various instances of such epidemics in schools, asylums, and prisons are on record. Thus, in France there were 30 cases in a girls' school, while epidemics have occurred in various Belgian prisons. Vaughn[27] has reported a series of 7 cases in New York and states that there were several other unrecorded cases in the Italian quarter at the same time. This is the only evidence of the occurrence of the epidemic form in America. Tetany is said to be endemic in Vienna, Prague, and Paris.

2. Tetany also occurs in *gastrointestinal disorders,* as diarrhœa, dyspepsia, gastrectasis, and intestinal worms. Fischl found that 66 per cent. of the cases of tetany were associated with gastrointestinal disorders; Ganzhofner, 81 per cent.; Kirchgasser, 75 per cent.; Cassel, 60 per cent. Hecker[11] believes that it is very probable that the intestinal disturbance is not the cause, but merely coincident with tetany, as it would otherwise be difficult to account for the fact that tetany is rare in summer, when intestinal catarrh is most prevalent. In our American series 24 of the 30 adult cases (80 per cent.) and 29 of the 47 infantile cases (61.7 per cent.) were of gastrointestinal origin. That is to say, in the whole series of American cases 68.8 per cent. had a coexisting affection of the gastrointestinal tract.

Gastric tetany forms one of the most characteristic groups. The form in association with dilatation of the stomach was first described

by Kussmaul in 1869. It is not common, as Riegel in his enormous clinic has seen only 4 cases, and was unable to collect more than 23 others. Richartz,[20] in 1904, in his careful analysis brought the total number in the literature to 43. We report 4 more. The dilatation, though usually due to cicatricial stenosis from ulcer of the stomach or duodenum, may be due to carcinoma ventriculi, distention of the gall-bladder, or a pancreatic cyst. Hyperacidity and hypersecretion of the gastric juice without evident gastrectasis may also be an etiological factor. Two of our cases were of this nature. Schlesinger, Moynihan and others have reported a chronic benign form of gastric tetany. In gastric tetany severe vomiting, less frequently the passage of the stomach tube or percussion over the stomach, are apt to precipitate an attack. Chronic diarrhœa or chronic constipation also predisposes to this condition. A few cases are on record, notably that of Riegel, in which intestinal worms were the supposed predisposing factor. Hoffmann has reported a case complicating jaundice.

3. Tetany occasionally occurs in the *acute infectious diseases*, as typhoid fever, cholera, influenza, measles, and scarlatina. In certain epidemics of typhoid fever tetany arises during the full height of the disease. Osler quotes Janeway* as having reported instances in this country. In cholera it is not unknown. Occasional examples are seen in scarlatina and measles. My tables show few examples of this group. Among the 77 cases there is a history of acute infection in 10. The infection was acute bronchitis and erysipelas in 3 cases each; scarlatina, influenza, pertussis, and otitis media occurred each in 1 case.

4. Tetany may follow poisoning from *chloroform*, *morphine*, *ergot*, *lead*, and *alcohol*. Under this group may also be mentioned tetany in association with the uræmia of chronic nephritis, a few examples of which occur in literature.

5. Tetany of the *pregnant*, *puerperal*, and *nursing women*. Trousseau originally described tetany under the name of "nurses' contracture." It may develop for the first time during pregnancy and recur in successive pregnancies. When already present, it may disappear with the onset of pregnancy and reappear in the later months. The onset occurs most commonly during lactation and, secondly, during the latter half of the period of gestation. When the menstruation is established tetany may reappear at each period. It is rare during labor and the puerperium. Dr. H. M. Thomas,[25] in 1895, offered the following hypothesis: "The occurrence of tetany during pregnancy depends primarily upon some abnormality in the function of the thyroid gland, and it is the unusual demands made upon this organ in the later months of pregnancy which make this a favorable time for the occurrence of the attacks." Schmid-

* Medical News, December, 1899. This reference has been found since going to press, hence is not included in our analyses.

lechner,[21] in 1905, reported a case with negative autopsy findings; he could find only 22 cases of tetany of this type in the literature. In America during the past decade there have been 3, possibly 4, cases belonging to this group.

6. *Tetany and Thyroid Deficiency.* Tetany may follow removal of the thyroid gland or, rather, as will be pointed out later, of the parathyroids. In 123 cases of total extirpation of the thyroid collected by Billroth and Wölfler there were 19 cases. In the large series of thyroidectomies at the Johns Hopkins Hospital, tetany has never developed. Tetany has been reported complicating myxœdema by Steinlechner and Joffroy on the Continent, and by James Stewart in America. In the latter's case there was no trace of the thyroid gland. No other cases of this type have been reported in America.

7. Tetany may complicate other *nervous disorders*, as exophthalmic goitre, cerebral and cerebellar tumor and syringomyelia.

There are other occasional causes, as sexual excess, masturbation, traumatism, and insolation.

B. Tetany in Children. Tetany occurs frequently in children in association with gastrointestinal disorders, acute infections, and rickets. In girls tetany has occurred at the time of puberty, especially when menstruation was delayed.

In Marseilles Oddo found 4 cases of tetany among 3500 cases under his care. Adams[1] collected from American literature 49 cases in children under two years. In these the associated condition was gastroenteritis in 21, rickets in 8, sepsis in 3, erysipelas in 2, not stated in 15. In the subsequent 21 cases collected by me there was gastroenteritis in 14 cases, rickets in 4 cases, and sepsis, erysipelas, acute bronchitis, and congenital syphilis each in 1 case. It is but fair to add that 9 more cases had rickets in addition to some other more evident associated condition.

Kassowitz's and Cassel's belief that tetany and laryngismus stridulus are caused by rickets finds its main support in the remarkable coincidence of both diseases, and in the parallelism of symptoms. In the first place there is evidence of rickets in 66 to 94 per cent. of children suffering from tetany or laryngospasm. In the second, the three affections occur in children between three months and three years of age. Finally, there is the frequency of all three during the spring season. But reliable observers from Prague and Gratz point out that only from 0.4 per cent. to 2 per cent. of the cases of rickets are attacked by tetany, and also that it is the mildest and not the severest cases of rickets that are associated with tetany, while, on the other hand, many cases of tetany show no evidence of rickets. Morse,[16] of Boston, does not believe rickets to be a great factor in the production of tetany, for out of 7114 children in his clinic he found 196 cases of rickets, but only 1 of tetany. Rudolph Hecker[11] believes that the close connection between tetany

and rickets is due to a factor common to both diseases, namely, the injury to the body by the bad air in the crowded houses of the poor during the winter and spring months.

MORBID ANATOMY. There are but few satisfactory records of postmortem examinations. In these very little has been found. Loos held that there was no definite lesion connected with the disease. It was, therefore, considered a neurosis by many. Weiss believed that tetany is due to an irritable condition of the gray matter of the medulla and spinal cord, which is due in its turn to sympathetic disturbances causing irregularities in the innervation of the bloodvessels of the spinal cord. Schlesinger believed that tetany is a disease of the entire nervous system, some of the symptoms being due to an affection of the peripheral nerves, but that the tetanic spasm and Trousseau's phenomenon are the result of increased excitability of the gray matter of the brain, medulla, and spinal cord. Stasse, Niemayer, and Schultze have found a peripheral neuritis in their cases. Baginsky considered it an affection of the peripheral ends of the nerves, due in some cases to a toxic irritation, especially when associated with disease of the gastrointestinal tract. Tonnellé, Blondeau, Grisolle, Trousseau, and Bouchut found hyperæmia of various portions of the brain and cord and their meninges. Langhans claims to have observed a periarteritis and periphlebitis of the bloodvessels of the white commissure, and of the anterior horns of the gray matter of the cervical portion of the spinal cord. Several observers (Bonome, Cervesato, Sarbo, and Ferranini) have found inflammatory changes in the ganglion cells of the anterior horns of the spinal cord and medulla. They state that there is first hyperæmia and swelling, later sclerosis and atrophy of the cells. Recently, R. Peters[19] found at autopsy in 8 cases of tetany an interstitial neuritis affecting the extradural portion of the roots of both the motor and sensory nerves. In Case 5 of our series MacCallum found in the parathyroid glands signs of unusual activity, namely, a great number of karyokinetic figures. The latter is a suggestive lead.

We must conclude, therefore, that pathologists are not all agreed as to the anatomical lesions that occur in tetany.

PATHOGENESIS. As yet we have to content ourselves with mere conjecture as to the pathogenesis of tetany.

Kussmaul formulated the *theory of dehydration*, which supposed a drying of the tissues of the body by the continual withdrawal of the body fluid, and, hence, a predisposition to an irritability and an instability of the nervous system. Dehydration may play an important role in tetany, associated with chronic diarrhœa, hypersecretion, and gastrectasis. It does not account for the other varieties. Kussmaul himself abandoned it, though recently Jürgensen has enthusiastically supported this theory.

The *reflex theory* was advanced by Germain-Sée, and supported

by Berlizheimer, Müller, and Collier. According to it the spasms are due to irritation of the hypersensitive terminal nerves of the mucous membrane of the stomach, which in turn excite the cells in the brain. This theory is quite untenable on account of many obvious objections. Thus, in the first place, reflex action can be responsible only for *evoking* and not for *generating* tetany; secondly, why is not tetany more common in the numerous severe gastric affections?

The *theory of intoxication* was the next to be advanced. This seems at once more attractive. The intoxication may be *exogenous*, as in the epidemic variety, which in many ways resembles an infectious disease. Carpenter,[4] in 1894, believed that in all cases of tetany sepsis can be assumed, and quoted cases illustrating his contention. He believed that sepsis resulted in anæmia, which, particularly in infants, in whom the irritability is very great, and the inhibitory centres insufficiently developed, often predisposes to convulsions and other nervous diseases, such as tetany. Further, a condition of unstable equilibrium is set up in the nerve centres, under which very slight influence will reproduce from habit the tetanic spasm.

But, at the best, exogenous intoxication can account for but a small number of the cases. It is rather from the *autogenous intoxication* theory that we can expect most. There are two organs which have been suggested as the site of the production of the toxin, namely, the stomach and the thyroid gland. Let us first discuss what one might call the gastric autointoxication school.

Brieger was one of the first to isolate from the gastric contents of sufferers from tetany a body closely allied to syntonin, which he believed to be capable of producing tetany. Flexner, Ewald, Albu, Jacobsen, Bouveret and Devic have all isolated other toxic bodies from the stomach. Bouveret and Devic,[3] in a very interesting paper, have shown that permanent hypersecretion in a dilated stomach may result in the development of some toxic substance in the gastric contents. They extracted a substance from the gastric juice in a case of tetany which produced typical spasms when injected into two dogs. The nature of the convulsive substance they were not able to determine, but believed it to be a peptotoxin which, acting with a syntonin, is given new properties by alcohol. The essential factors in the production of this peptotoxin are free hydrochloric acid and alcohol in the presence of peptones. Further, they proved that Brieger's peptotoxin is produced in the course of extraction, and does not exist in the stomach of the patient, which statement they admit may be true of their own peptotoxin. Frankl-Hochwart objects to these experiments of Bouveret and Devic, as he believes their cases were not proven to be gastric tetany, on account of the absence of Trousseau's, Chvostek's and Erb's phenomena. Let us add that Albu, Gumprecht, von Jaksch, Dickson and others have

repeatedly failed to reproduce tetany by injecting into animals *untreated* gastric contents from cases of tetany.

Other supporters of the autogenous intoxication theory advance a disordered thyroid metabolism for consideration. Thus, Dr. H. M. Thomas,[25] in 1895, wrote: "I am inclined to entertain the opinion that it is probable that tetany occurring under other conditions (than pregnancy) will in most cases be found to be due to an insufficiency, absolute or relative, in the action of the thyroid gland or like structures. If this be true it may serve to explain why the disease occurs so frequently in certain localities and is so rare in other places." Many observers, among others, Halsted in America, have produced tetany experimentally by complete removal of the thyroid gland. Gley, Vassale, Generali in Europe, and W. G. MacCallum in America, have shown that tetany following extirpation of the thyroid gland in dogs is due not to the loss of the thyroid function but to the coincident removal of the parathyroid glands. When these glands are removed a poison which was formerly neutralized by them acts upon the central nervous system and produces tetany. MacCallum believes that spontaneous tetany is apparently the result of the production of so much of this unknown poison that the normal parathyroids are insufficient to neutralize it. An abnormal activity of the cells of the parathyroid gland in Case 4 of our series is a suggestive finding in confirmation of this theory. Notkin has described a body called thyreoprotein, and Fränkel has isolated from the thyroid a body called thyreoantitoxin, both of which are capable of neutralizing the toxin in the blood of the thyroidectomized animals.

Lastly, Fleiner regards the action of poisonous products of metabolism as of less importance than other factors and incapable of acting without them. These factors are the heightened mechanical and electric irritability of muscles and nerves, and especially the influence of voluntary innervation of the muscles in the presence of a disposition to tetany. In other words, he considers a tetanic spasm as the conversion of a voluntary into an involuntary muscular contracture. He assigns the cause of the heightened mechanical and electric irritability to the old theory of Kussmaul—*i. e.*, dehydration of the body in general, but especially of the muscles, nerves, and the central nervous system. The great objection to Fleiner's theory is that it suffices only as an explanation for the gastric form of tetany.

SYMPTOMATOLOGY. Let us now discuss in detail the various symptoms.

Muscular Cramps. These are the characteristic feature of the disease. The *exciting causes* are overexertion and exhaustion, muscular effort, emotion, sudden changes in temperature, an attack of vomiting or acute diarrhœa, percussion over the stomach, gastric lavage, or pressure on the affected limb. There are usually definite *prodromata*, as numbness, tingling, and formication in the extremities,

which were present in 13 of my series. Occasionally headache, malaise, and mental depression occur. Vomiting was the precursor of the paroxysm in 14 cases.

The spasms have certain definite features. They are bilateral and tonic in character, usually commencing at the periphery and gradually spreading upward until the entire musculature of the body may be involved. The hands are most commonly affected, giving rise to the so-called "obstetrical hand," from the fact that the fingers are flexed at the metacarpophalangeal joints, extended and adducted at the two distal joints, while the thenar and hypothenar eminences are contracted so as to deepen the palm of the hand, and the thumb is strongly flexed across the palm. The hand may then be flexed at the wrist and drawn toward the ulnar side; the forearm semipronated and flexed at the elbow; the arm drawn closely to the side or flexed across the thorax. The muscles of the shoulder girdle are rarely involved. In the lower extremities the feet assume a position of talipes equinovarus, with inversion of the foot, plantar flexion of the tarsus and metatarsus, while the toes are flexed on the sole at the metatarsophalangeal, and extended at the distal joints. In severe cases the leg may be flexed on the thigh and the thigh on the pelvis. All four extremities or only one may be attacked. In my series both the arms and legs were involved in 61 cases, the arms alone in 14, and the legs alone in 2 cases, of which both were children. Occasionally spasm occurs in the muscles of the face, resulting in the "risus sardonicus." This was present in 18 cases. Still more rare is the involvement of the muscles of mastication (trismus), though that this does occur in tetany as well as in tetanus must not be forgotten, as it was present in 10 of my series. Spasm of the muscles of the neck, or of the back, or of both, was present in 24 cases, and in several gave rise to well-marked opisthotonos. The thoracic and abdominal muscles were involved in 6 and 3 cases, respectively. Spasm of the larynx is not uncommon in children (10 cases in my series), and in association with rickets may be the predominating feature. In adults laryngospasm is of grave moment and occurred but twice in 37 cases, of which one recovered and the other died. The tongue and eye muscles may also be involved, as was true of each of 2 cases. In severe cases, as in 3 of my series, the diaphragm itself does not escape. In a few isolated cases the bladder has been attacked. The paroxysm is usually intermittent, though it is sometimes continuous with exacerbations of the spasm. While usually tonic in character it may be clonic at the onset, and in some cases from this fact may be mistaken for epilepsy; though it should be borne in mind that in true epilepsy the tonic stage always precedes the clonic. A general convulsion occurred in 13 cases of my series, of which 9 were children.

Laryngospasm. A few words about this special form of spasm, commonly known as laryngismus stridulus, will not be out of place. Escherich and Loos maintain that laryngospasm has no causal connection with rickets, and is but a special form of tetanic spasm of the respiratory muscles. Escherich found in 300 cases of laryngospasm the symptom-complex of tetany was absent only two or three times. Ganghofner found that 94 per cent. and Fischl 63 per cent. of these cases presented tetany symptoms. Kassowitz and Kalischer deny any relation between tetany and laryngospasm. Cassel found spasm of the glottis only twice in 60 cases of tetany, while in 116 cases of laryngospasm tetany occurred only twice. Further, both Cassel and Kassowitz regard laryngospasm as a nervous symptom of rickets. This great divergence of opinion depends upon the various conceptions by the numerous observers of the features essential for a diagnosis of tetany. Now most are agreed that in the majority of cases laryngismus stridulus is associated with tetany, but also that a certain number of cases of laryngospasm form a special group independent of tetany.

Accessory Phenomena. There are certain accessory phenomena which are more or less characteristic of tetany.

1. *Trousseau's Phenomenon.* Pressure on the nerve trunks and bloodvessels of the affected limb, more especially of the upper extremity, will reproduce a typical spasm. This susceptibility may last some time after the cessation of a tetanic spasm, though it is by no means invariably present. It was positive in 80 per cent. of the 45 cases of my series in which it was tested (positive in 36, doubtful in 3, and negative in 6 cases). It is the first of the accessory symptoms to disappear. In children the phenomenon is not as marked; generally, only adduction of the thumb, curving and adduction of the fingers, and pronation of the hand occur. It is said to be often present in hysteria.

2. *Chvostek's phenomenon* implies increased mechanical irritability of the motor nerves and the muscles. Thus, on tapping the motor nerve supplying the affected muscles the spasm will be reproduced. The so-called "facial phenomenon" may be produced by gentle pressure over the seventh cranial nerve, either at its exit from the stylomastoid foramen or along its extracranial course. Schultze found mere stroking of the face will produce blinking of the eye or drawing up of the angle of the mouth. In my series it was present in but 20 of the 40 cases in which it was tested for (50 per cent.). This facial phenomenon is said to be also found in hysteria, epilepsy, chorea, and other nervous affections.

Escherich in his *Traite des Maladies* describes the "mouth phenomenon" which implies the occurrence, after tapping the corner of the mouth or the upper lip, of a contraction of the orbicularis oris on the opposite side, while at the same time the lips are

brought forward as if for whistling. Thiemich described in 2 cases the labial phenomenon, which is a sudden contraction of the orbicularis oris occurring in the waking child on tapping any part of the upper lip, the mouth being brought forward in a snout-like manner.

3. *Erb's phenomenon* implies increased electric irritability of the motor nerves and muscles to both the interrupted (faradic) and the constant (galvanic) current, but more especially to the latter. It is the most constant phenomenon, and may be demonstrated for weeks after the disappearance of the spasm. Frankl-Hochwart always found increased galvanic irritability, though in my series it occurred in only 12 of the 15 cases tested (80 per cent.). The ulnar nerve is usually the most susceptible to this reaction; the facial nerve rarely so. In health the earliest and greatest response is seen on closure at the cathode pole, while in tetany a prompt contraction is seen at either pole, being practically alike on opening or closing. H. M. Thomas[25] found in his case the rare phenomenon which he called "catelectrotonus tetanus." That is to say, with the cathode on the nerve, when the current was still very weak, often before the galvanometer indicated the passage of any current, one could notice fibrillary contractures in the muscles, and as the current was increased the contractures became more marked and the muscles began to be tetanized; this tetanus continued to increase until all the muscles supplied by the nerve were thrown into a strong, steady spasm, which passed off suddenly if the current were broken, or gradually if it were gradually decreased. If the anode were substituted for the cathode, no such occurrence took place. This contraction has been noticed but once before by von Bechterew. Peters[19] has recently called attention to the "jumping-jack sign." This is brought out by placing the anode on the breast and the cathode on the lower cervical vertebræ; stimulation by a current of 3 to 4 milliampères will cause the arms to jerk up and out like a child's toy. Further, this author has found that the cerebrospinal fluid is increased, and that after lumbar puncture it is impossible to elicit the "jumping-jack sign," owing to the relief of the pressure in the spinal canal.

4. *Sensory Phenomena.* There is pain during the spasm in severe cases, sometimes of great intensity. Pain or tenderness was present in 43 of the 47 cases where this point was noted. Superficial distress occurs in the form of formication and burning. Paræsthesiæ also occur as sensations of heat and cold and "pins and needles." Anæsthesia occurs rarely—being present to a slight degree in 2 cases, but to a marked extent in 1 case associated with paraplegia. Optic neuritis has been reported in obscure cases. The sensorium remains clear, as a rule, and loss of consciousness is the exception, though in my series there was delirium in 1 case and unconsciousness in 4 cases.

Hoffmann's phenomenon implies increased irritability of the sensory nerves to both mechanical and electric stimulation. In other words, tapping over a sensory nerve or the passage of an electric current through the affected region will result in paræsthesiæ or even pain. Unfortunately this sign was tested in only 4 cases, but was found present in 3 (75 per cent).

The tendon reflexes are variable, being sometimes increased (13 cases), sometimes diminished (4 cases), or even absent (4 cases), and sometimes normal (13 cases). The epileptiform attacks which are observed in tetany are rightly considered not a mere complication, but as being manifestations of the symptom-complex.

5. The *phrenic phenomenon* was first described in 1902 by Solovieff.[22] He observed in 2 cases a drawing in of the lower intercostal spaces of the left half of the thorax with each heart beat. Further, on radioscopic examination the left half of the diaphragm contracted with each heart beat, while the right half contracted only with each respiration. The value of this sign remains to be determined.

Vasomotor and Trophic Phenomena. In the chronic and more rarely in the acute forms of tetany one finds secretory and trophic disturbances. Thus solid œdema of the hands or feet with redness of the overlying skin may develop, and either disappear during the paroxysm or persist in the intervals. It was present in 11 cases of my series. Occasionally there is effusion into the tendon sheaths or joints. Flushing of the face (3 cases), injection of the eyes, redness or even marked cyanosis of the ears or hands (4 cases) are not unknown. Sweating (3 cases), dryness of the skin, desquamation (1 case), falling out of the hair or nails are seen. Occasionally one observes erythematous, herpetiform, scarlatinal, morbilliform, and urticarial eruptions. In my series one case showed an erythema, while in another a definite purpura was noted. Pigmentation of the skin also occurs, due possibly to vascular obstruction from spasm of the underlying muscle. Cataract is also seen. Peters believes the latter to be due to obstruction of the circulation in the vessels adjacent to the lens from spasm of the ciliary muscle, and hence to interference with its nutrition.

General Symptoms. The pulse is often accelerated. There may be rapid breathing or even dyspnœa from spasm of the diaphragm. The temperature, though usually normal, may range between 99° and 101°. The pupils, according to Bouveret and Devic, and Cunningham, are contracted during the attack of tetany. Trevilian and Kussmaul have observed widely dilated, immobile pupils during the paroxysm. Transitory blindness has been recorded by Kussmaul, Bouveret, Trevilian, and Cunningham.

The urine varies greatly. Hoffmann, Neuser, Mader and Frankl-Hochwart on the Continent and Locke in America have each

reported a case of polyuria. More usually there is diminution in the amount of urine, if not complete suppression, especially during a severe attack. This occurred twice in my series. Albuminuria, we believe, is frequent during and immediately following the paroxysm, though there may be no evidence of renal disorder postmortem. Albumin was present in 9 of 21 cases in our series where this was noted; 6 of these 9 were cases from the Johns Hopkins Hospital. The presence of albuminuria further suggests the toxic nature of tetany. Among 72 cases of tetany in children examined by Loos, only 2 showed albumin in the urine. Tube casts were found in one case reported by Cunningham.[16] Acetonuria, aceturia, and, more rarely, glycosuria, occur. Indicanuria has been observed by some. Ewald has also isolated a peptotoxin from the urine.

DIAGNOSIS. Anyone conversant with tetany will be at once struck with the manifold and apparently dissimilar conditions with which it may be associated. One is forced to conclude, from a consideration of these, that tetany is not a disease *sui generis*, but rather a symptom complex. Morse,[16] in 1898, wrote: "Like epilepsy tetany must be regarded as a nosological entity and not as a definite disease." Frankl-Hochwart, Fleinert and Ury restrict the term tetany to a condition in which typical muscular spasms exist together with the accessory phenomena of Trousseau, Chvostek, Erb and Hoffmann. Morse and others believe that the only pathognomonic symptom of tetany is the spontaneous, intermittent, muscular contracture. The former states that Trousseau's, Erb's, and Chvostek's phenomena are not pathognomonic of tetany and do not either singly or in combination afford sufficient ground for the diagnosis of the disease, because they are not constantly present and may occur in many other conditions. Frankl-Hochwart, however, recognize, in addition to *true* tetany, incomplete, latent, and so-called tetanoid forms, where spontaneous spasm is absent, but where Trousseau's, Erb's, and Chvostek's phenomena are present. He also recognizes cases with typical muscular spasm without these accessory phenomena. Strong believes that these tetanoid forms are usually in association with some gastric derangement. During the past year we had under observation a neurotic woman, thirty-four years of age (Hosp. No. 48795), who, following severe and persistent nervous vomiting, complained on several occasions of numbness and cramps in her hands. Twice during gastric lavage there was a definite tetanic spasm of the hands and wrists which disappeared after the withdrawal of the tube.

One other patient (Hospital No. 5841), suffering from carcinoma of the pylorus, with vomiting of large quantities of fluid, also complained of cramps in the hands and stiffness in the jaws. Two days after this complaint the muscles of the arms and feet became rigid and drawn up. This spasm lasted for seven to nine minutes

and then disappeared. No Trousseau's phenomenon could be elicited.

DIFFERENTIAL DIAGNOSIS. A typical case of tetany should present no difficulties. Under some circumstances one has to exclude tetanus, hysteria, meningitis, and epilepsy. In *tetanus* the spasms are more continuous and beginning in the masseter muscles spread to the throat and trunk. There is also pyrexia. The course of the disease is progressively downward. Furthermore, a source of infection is often found.

Hysteria may simulate tetany to a remarkable extent. Here, however, the contractures are rarely bilateral. Psychoses of various forms are prominent. Sensory disturbances, transitory paralyses, emotional outbreaks, or optic difficulties are present. Convulsions with more or less loss of consciousness occur. In women ovarian tenderness is also suggestive. Trousseau's phenomenon is usually absent, though Charcot and others state that it may occur in hysterical subjects. We cannot agree with Gilles de la Tourette, Raymond and Murray[18] that nearly all cases of tetany are manifestations of hysteria.

A case illustrating the similarity of hysteria to tetany occurred in the medical service of the Johns Hopkins Hospital (Hosp. No. 40797).

Though possibly it might have been considered tetany by some observers, we have not included it in our series, in view of the well-marked hysterical stigmata present, and the subsequent history of the case.

Meningitis. The character and distribution of the spasm, and the more pronounced general as well as the sensory symptoms, together with the absence of the peculiar excitability of tetany, serve to differentiate spinal meningitis. In children, however, tuberculous meningitis may be misleading. Frankl-Hochwart quotes the case of a four-year-old boy, who, during anæsthesia for an operation for tuberculosis of the knee-joint, developed typical tetany of the hands. Two days later he died of tuberculous meningitis. In the colored wards of the Johns Hopkins Hospital a female child one year old developed, twelve hours before death, general convulsions with typical tetanic spasms of the upper and lower extremities, which were only partially relaxed by chloroform. At the autopsy a tuberculous meningitis was found.

In *epilepsy* of the Jacksonian type the spasm begins always unilaterally, and, if it becomes general, consciousness is lost. The paroxysm is of short duration, and is followed by weakness for a definite period in the muscles first affected.

PROGNOSIS. The outlook is usually good. The chief danger occurs "when the paroxysms are very violent, causing considerable and repeated interference with respiration, with signs of œdema of

the lungs" (Gowers). In children with chronic diarrhœa the mortality is high. In tetany associated with gastrectasis the mortality is still higher, ranging from 60 to 70 per cent. according to the most conservative estimates. Tetany following acute infection, exposure to cold, exhaustion, rickets, and the administration of toxic substances, generally runs a mild course. In the epidemic variety the prognosis is very favorable. Tetany in pregnancy and lactation is scarcely ever serious, and commonly ceases at the birth of the child or after weaning. Tetany excited by labor pains has occasionally led to fatal results. In "surgical tetany" or that following the total extirpation of the thyroid gland, the course may rapidly prove fatal. In Billroth's series of 12 cases, 8 died, 2 became chronic, and 2 recovered.

TREATMENT. The first indication is to correct the predisposing condition, such as the diarrhœa, vomiting, pregnancy, etc. In the gastric variety one should practice frequent lavage with large quantities of warm fluid, either plain water, normal salt solution, or some mild antiseptic, as Condy's fluid or boric acid. Greenfeld recommends a solution consisting of two drachms of sodium phosphate to a pint of water. Purges and emetics also help, while active diaphoresis and diuresis should never be omitted. In the form associated with gastrectasis surgical intervention is certainly indicated. Cunningham[6] and Warbasse[28] have collected 9 cases treated surgically, with a mortality of 33.5 per cent., as compared with a mortality of 65 to 70 per cent. in the cases treated by medical means.

The operations of gastrojejunostomy, or pyloroplasty relieve the stagnation of the stomach contents and so prevent further absorption of the toxic substances, whatever they may be.

In the tetany of pregnancy and in any cases associated with thyroid deficiency the exhibition of thyroid extract is indicated. Very remarkable results have been obtained by Bramwell and Gottstein in Europe and Cabot in America, by the use of thyroid extract in tetany other than that of pregnancy. Maestro, after treating three cases in children with raw or slightly cooked thyroid gland, concluded that the method is exceedingly useful, as it always diminished the intensity and the frequency of the attacks and shortened the duration of the disease. Negative results have also been reported.

Vassale had great success with the administration of parathyroid extract in a case of a child with tetany. Beidl, however, in experimental tetany in parathyroidectomized animals, found the use of parathyroid extract only of slight benefit, whereas larger doses of the thyroid gland were followed by surprising results. Dr. H. M. Thomas' case is being fed with parathyroid extract with apparent benefit by Dr. W. G. MacCallum.

For the spasms themselves, absolute rest in bed, cold to the spine, tepid baths, hot packs, opium, bromides, chloral, and other drugs have been tried with little or no result. The administration of chloroform to primary anæsthesia may lessen the severity of the spasm.

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ANALYSIS OF THE CASES OF TETANY IN ADULTS IN

+ = positive. − = negative.

No.	Author and journal.	Sex, and age.	Associated disease.	Prodromata.	Muscular spasm.			Trousseau.	Chvostek.	Erb.	Hoffmann.
					Site.	Intensity.	Duration.				
A.	***With Dilatation of the Stomach.***				**I.** ***Gastric Tetany.***						
1	James. Presb. Hosp. Reports, 1896.	M. 29	Pyloric stenosis.	Abdominal pain, vomiting.	Legs, arms, abdomen, face, and neck.	Severe.	48 hrs.	−	+	0	0
2	Preble. Journ. Amer. Med. Assoc., 1898.	M. 32	Gastrectasis.	Vomiting.	Arms and masseters.	Mild.	0	−	−	0	0
3	Ladd. Med. Council, 1901.	M. 29	Gastrectasis.	Vomiting.	Arms, legs, abdomen.	Severe.	24 hrs.	0	0	0	0
4	Strong. Bost. Med. and Surg. Journ., 1902.	M. 43	Gastrectasis.	Abdominal pain, vomiting.	Arms, legs, face.	Moderate	2 wks.	+	0	0	0
5	Cunningham. Ann. of Surg., 1904.	M. 28	Pyloric stenosis.	Vomiting, numbness, and tingling of hands.	Arms, legs, face.	Severe.	20 mos.	+	+	0	0
6	Warbasse. Ibid., 1904.	M. 33	Gastrectasis. (slightly)	Vomiting, dizziness, choking.	Legs, arms, face, neck, and back.	Severe.	4 yrs.	0	0	0	0
7	Howard. Case 2.	M. 24	Gastrectasis.	Tickling in legs.	Arms, legs, face.	Severe.	3 wks. +	+	+	+	0
8	Ibid. Case 3.	M. 52	Gastrectasis.	Faintness and pallor.	Hands and forearms.	Mild.	3 min.	0	0	0	0
9	Ibid. Case 4.	M. 58	Pyloric stenosis.	Numbness, epigastric pain.	Arms, legs, and face.	Severe.	48 hrs.	+	+	0	0
10	Ibid. Case 6.	M. 45	Gastrectasis.	Numbness and formication.	Arms and face.	Moderate	3 mos.	+	−	−	−
B.	***Without Dilatation of the Stomach.***										
11	Larrabee. Bost. Med. and Surg. Journ., 1899.	F. 26	Acute gastric.	Headache and nausea.	Arms.	Mild.	24 hrs.	+	−	0	0
12	Hill. Col. Med. Journ., 1899.	F. 34	Acute gastric.	Numbness and tingling.	Arms, legs, face, and throat.	Moderate	2 hrs.	+	+	0	0
13	Strong. Bost. Med. and Surg. Journ., 1902.	F. 18	Acute gastric.	Vomiting and headache.	Arms and masseters.	Mild.	3 hrs.	?	+	−	0
14	Einhorn. XXth Cent., 1896.	M. 28	Chronic gastric.	Pain in epigastrium, restless.	Arms and legs	Moderate	Every week.	0	0	0	0
15	Bundy. Phil. Med. Journ., 1899.	M. 22	Gastric.	Gastric irritability.	Arms, legs, face, neck, abdomen, and thorax.	Severe.	4 wks.	+	−	−	0
16	McCaskey. Fort Wayne Journ., 1899.	M. 23	Gast. hyperacidity.	Aching pain.	Legs and hands.	Severe.	4 wks.	?	0	0	0
17	Hunter. Stylus, 1900.	F. 40	Gastric.	Aching and swelling of joints.	Hands, feet, trunk, diaphragm, and masseters.	Severe.	7 yrs.	0	0	0	0

[1] Reports of 17 cases by the following authors were not included by reason of the incompleteness of data, no data); 3 cases by Turck in 1898 (no data); 1 case by Wilson in 1899 (no data); 3 cases by Strong in 1902 otal to 47 cases of adult tetany.

AMERICA FROM JANUARY 1, 1895, TO JANUARY 1, 1905.[1]

0 = not stated. ? = doubtful.

Sensory phenomena.	Unusual phenomena.	Reflexes.	Temp. (° F.), pulse, resp.	Urine.	Bowels.	Result.	Remarks.
A. *With Dilatation of the Stomach.*					**I. *Gastric Tetany.***		
Pain.	Cyanosis, motor aphasia, fibrillary contraction of muscles, trismus, risus sardonicus, opisthotonos.	Normal.	T. 101–105 P. 120–140 R. 24	0	Constipation.	Death.	Previous attack 6 months ago; acute nephritis at autopsy.
0	0	Exaggerated.	T. 101	Normal.	Diarrhœa	0	Pulmonic hypertrophic osteoarthropathy also present.
0	0	0	T. 100	0	0	Death.	Death after second attack; at autopsy perforation of cardia.
0	0	0	0	0	Constipation.	Well.	Gastric analysis showed T. a. 0.21, HCl 0.0365 per cent.
Pain.	Unconscious, trismus, motor aphasia, poor vision, contraction of pupils.	Exaggerated.	T. 99 P. 100–126	Albumin and casts.	Constipation.	"	T. a. 0.3, HCl 0.18 per ct., hb. 60 per ct., r. b. c. 4, 900,000, w. b. c. 9,000; spasm induced by lavage; post. gastroenterostomy.
No pain.	Unconscious, convulsions, spasm of glottis.	0	0	0	0	"	Foreign bodies in stomach; gastrotomy twice.
0	Fibrillary muscular tremors in hands.	Normal.	T. 98 1/5 P. 88–92	Trace of albumin.	Diarrhœa	Unimproved.	Death eight months later from cachexia; hb. 30 per ct., r. b. c. 2,460,000, w. b. c. 3,600, T. a. 56, HCl 21.
0	Twitching of arms.	0	T. 98 3/5 P. 68–80	Trace of albumin.	Constipation.	Well.	T. a. 66, HCl 54; one attack during removal of test meal.
Agonizing pain.	Stupor, anuria, dysphagia.	Exaggerated.	T. 90.5 P. 76–104 R. 20–24	Moderate albumin.	Regular.	Death.	Marked stagnation of gastric contents; T. a. 40, HCl 10, hb. 70 per ct., r. b. c. 4,056,000, w. b. c. 17,480; at autopsy ch. nephritis.
Severe pain.	0	Diminished.	T. 101 P. 68–96	Trace of albumin.	Constipation.	Unimproved.	Hb. 83 per ct., r. b. c. 4,586,000, w. b. c. 5,140, T. a. 30, HCl 19; slight retention of gast. contents.
B. *Without Dilatation of the Stomach.*							
Severe pain and prickling.	Syncope.	0	Normal.	0	Regular.	Well.	Tetany followed a dietetic error.
Pain.	Congestion of face.	0	Normal.	0	0	"	Symptoms of hyperacidity and possibly gastric ulcer.
Hyperæsthesia.	0	Normal.	T. 99.8	0	0	"	Fatigue factor present.
0	Trismus, alternating with epileptiform convul.	0	0	0	0	Improved.	HCl diminished.
Pain, itching of skin.	"Claw hand" at times.	Normal.	0	0	0	Well.	For five years had attacks of tetany of two to three days' duration.
Pain, paraplegia, and anæsthesia at onset.	"Claw hand"	Exaggerated.	P. 108	Normal.	Regular.	"	T. a. 90, HCl 40; hysteria possibly.
Pain.	Opisthotonos, trismus, redness of face.	0	T. 100.5	Albumin.	Constipation.	"	Occurred twice in pregnancy; attack began at sixth month.

or the probable unsuitability of the diagnosis: 3 cases by Murray in 1896 (hysteria); 1 case by Lloyd in 1897 (no data); 5 cases by Brown in 1902 (no data); 1 case by Gordon in 1908 (hysteria). These would bring the

No.	Author and journal.	Sex. and age.	Associated disease.	Prodromata.	Muscular spasm.			Trousseau.	Chvostek.	Erb.	Hoffmann.
					Site.	Intensity.	Duration.				
B. *Without Dilatation of the Stomach.*											
18	Morgan. Phil. Med. Journ., 1901.	M. 40	Gast. hyperacidity.	Vomiting and lassitude	Arms.	Severe.	7 yrs.	0	0	0	0
19	Morgan. Ibid.	F. 60	Gast. hyperacidity.	Gastric distress and weariness.	Arms and neck.	Moderate	8–10 mos.	0	0	0	0
20	Howard. Case 1.	M. 46	Gast. hyperacidity.	Vomiting.	Hands, feet, face, and limbs.	Severe.	3 mos.	—	—	+	0
21	Ibid. Case 5.	M. color. 18	Gast. hyperacidity.	Tingling in hands.	Hands and feet.	Moderate	3 wks. +	+	+	+	0
II. *Intestinal Tetany.*											
22	Ibid. Case 7.	M. 28	Chronic diarrhœa.	Tingling in fingers.	Arms, legs, and neck.	Severe.	6 mos.	+	+	+	0
III. *Gastrointestinal Tetany.*											
23	Strong. Bost. Med. and Surg. Journ., 1902.	M. 44	Gastro-enteritis.	0	Arms and jaws.	Mild.	0	0	0	0	0
24	Brown. Med. News, 1902.	M. 29	Gastro-enteritis.	Colic and nausea.	Legs, arms, and trunk.	Mild.	3–4 wks.	0	+	0	0
IV. *Tetany of Pregnancy and Lactation.*											
25	Thomas. Johns Hopkins Hosp. Bull., 1895.	F. 33	Pregnancy, para VII.	Fatigue and aching.	All muscles, face, and larynx.	Severe.	12 yrs.	+	+	+	0
26	Lothrop. Bost. Med. and Surg. Journ., 1896.	F. 30	Pregnancy, para IV.	Numbness and prickling of hands, nervousness.	Arms, legs, and face.	Severe.	10 wks.	+	+	+	+
27	Bundy. Journ. Nerv. and Ment. Dis., 1899.	F. 32	Lactation, para III.	0	Arms.	Slight	3 mos.	+	+	+	+
V. *Unclassified Tetany.*											
28	Park. New York Med. Journ., 1896.	F. 37	Lactation, pertussis.	Cramp in arms, spasm of glottis.	Legs, arms, back, jaw, glottis, diaphragm.	Severe.	2 mos.	0	0	+	0
29	Smith. Phil. Med. Journ., 1899.	M. 21	Sudden exertion.	"Oppression."	Arms, legs, abdomen, tongue.	Severe.	20 min.	0	0	0	+
30	Locke. Bost. Med. and Surg. Journ., 1902.	M. 33	Alcohol, exertion, exposure.	Numbness, vomiting and micturition.	Arms, legs, rt. st. mast.	Severe.	23 hrs.	+	0	0	0

Sensory phenomena.	Unusual phenomena.	Reflexes.	Temp. (° F.), pulse, resp.	Urine.	Bowels.	Result.	Remarks.
B. *Without Dilatation of the Stomach.*							
Intense pain.	Muscular twitchings.	0	0	Normal.	0	Well.	Recurring attacks for 7 years; occasional unconsciousness.
Pain.	Swelling of muscles of neck.	Normal.	T. 99.8 P. 60	0	Regular.	"	Complicated by epilepsy; tetany once after lavage.
Pain, mental excitement.	Pain in abdomen.	Diminished.	T. 98–100 P. 76–120	Normal.	Constipation.	"	Hypersecretion; gastric ulcer(?); T. a. 70, HCl 65, hb. 95 per ct., r. b. c. 5,516,000, w. b. c. 9,000.
No pain; dizziness, vertigo.	Delirium, dysuria.	Normal.	0	0	Constipation.	"	Gastrectasis (?); T. a. 95, HCl 71; no enlargement of thyroid.
II. *Intestinal Tetany.*							
0	Convulsions.	k. k. sluggish.	Normal.	Trace of albumin.	Diarrhœa	Well.	Clubbing of fingers, no goitre, marked subacidity of gastric juice; hb. 78–94 per ct., r. b. c. 5,165,000, w. b. c. 9,000; gunshot wound of head eight years previous.
III. *Gastrointestinal Tetany.*							
Weakness and stiffness of hands and legs.	0	0	0	0	Diarrhœa	0	Russian; gastric tymp. one inch below navel.
Pain, slight anæsthesia.	0	0	0	0	Diarrhœa	Well.	
IV. *Tetany of Pregnancy and Lactation.*							
Intense pain.	Cyanosis and swelling of hands, fibrillary contract. orb. path.	Exaggerated.	T. norm. P. 76–104	Normal.	Normal.	Well.	Occurred in last half of six pregnancies.
Pain and hyperæsthesia.	Flushing, sweating, and fibrillary twitching of face.	Absent.	T. 100⅕ P. norm.	Normal.	Constipation.	"	Tetany two hours one year ago; now seven months pregnant; cessation after labor.
0	0	0	0	0	0	0	Italian; first attack 7 years ago; occur every spring, especially at lactation.
V. *Unclassified Tetany.*							
Pain.	Cyanosis, hiccough, spasm of diaphragm, trismus, opisthotonos.	0	0	0	0	Well.	Patient had chronic endometritis; under severe nervous strain; tetany at succeeding menses.
0	Cyanosis, dyspnœa, motor-aphasia.	0	0	0	0	"	
Tingling and numbness, slight anæsthesia.	Cyanosis, sweat.	0	0	Polyuria.	0	"	Prolonged exertion in cold and wet; three attacks in seven years.

ANALYSIS OF THE CASES OF TETANY IN CHILDREN IN

+ = positive. — = negative.

	Author and journal.	Sex and age.	Associated disease.	Prodromata.	Muscular spasm.			Trousseau.	Chvostek.	Erb.	Hoffmann.
					Site.	Intensity	Duration.				
1	Preston. New York Med. Jour., 1895.	F. 3½ yrs.	.....	0	Arms and legs.	Slight.	2 yrs.	+	0	0	0
2	Lewi. Arch. of Pediatrics, 1895.	M. 9 mos.	Rickets.	Convulsions.	Hands and feet.	Mild.	3 wks.	0	0	0	0
3	Lewi. Ibid.	M. 8 mos.	Intestinal (?) rickets.	Irritability and constipation.	Hands and feet.	Severe.	10 wks.	0	0	+	0
4	Lewi. Ibid.	M. 8 mos.	Gastro-intestinal (?) rickets.	Irritability and vomiting.	Hands and feet.	Mild.	14 dys.	0	0	+	0
5	Lewi. Ibid.	M. 13 mos.	Gastro-intestinal (?) rickets.	Fever, vomiting, laryng. stridulus.	Hands and feet.	Mild.	14 dys.	0	0	0	0
6	Crandall. Ibid., 1895.	M. 6 mos.	Bronchitis, rickets.	Twitching, staring of eyes.	Arms, legs, face, and neck.	Severe.	4 wks.	0	0	0	0
7	Crandall. Ibid.	M. 12 mos.	Gastro-intestinal (?) rickets.	Laryng. stridulus.	Arms, legs, face, and larynx.	Severe.	5 wks. (?)	0	0	0	0
8	Lothrop. Bost. Med. and Surg. Journ., 1896.	M. 3 yrs.	Gastro-intestinal.	Vomiting.	Arms and legs.	Moderate	3 wks.	+	+	0	0
9	Lothrop. Ibid.	M. 18 mos.	Sup. otitis media, rickets.	0	Hands and feet.	Moderate	Few mos.	?	+	0	0
10	Krauss. Med. Record, 1896.	M. 6 mos.	Gastro-intestinal, dentition.	None.	Arms, legs, face, and diaphragm.	Severe.	5 wks.	+	0	0	0
11	Krauss. Ibid.	M. 18 mos.	Gastro-intestinal, bronchitis.	0	Hands and feet.	Mild.	1 wk.	0	0	0	0
12	Krauss. Ibid.	M. 13 mos.	Gastro-intestinal, bronchitis.	0	Hands and feet.	Mild.	6 dys.	0	0	0	0
13	Krauss. Ibid.	F. 9 mos.	Bronchitis.	0	Hands and feet.	Mild.	3 wks.	0	0	0	0
14	Krauss. Ibid.	F. 11 mos.	Gastro-intestinal, bronchitis, dentition.	0	Hands and feet.	Moderate	2 wks.	0	0	0	0
15	James. Presb. Hosp. Rep., 1896.	F. 6 yrs.	Gastro-intestinal.	0	Arms, legs, jaw, abdomen.	Moderate	2½ mos.	+	0	0	0
16	Ferguson. Pediatrics, 1896.	M. 10 mos.	Phimosis.	0	Arms and legs.	Slight.	Several months.	0	0	0	0
17	Ferguson. Ibid.	M. 18 mos.	Gastro-intestinal.	0	Hands, feet, jaws, orb. oris.	Slight.	1 wk.	—	0	0	0
18	McConnell. Canada Med. Record, 1896.	M. 5½ yrs.	Scarlet fever.	0	Legs and arms.	Moderate	1 wk.	+	+	0	0
19	Morse. Journ. Amer. Med. Assoc., 1898.	F. 4 mos.	Intestinal, mastoiditis.	0	Hands and arms.	Slight.	0	+	—	0	0
20	Morse. Ibid.	F. 4 mos.	Intestinal.	0	Hands and arms.	Slight.	0	+	—	0	0
21	Morse. Ibid.	F. 10 mos.	Rickets.	0	Hands, arms, and larynx.	Moderate	4½ wks.	—	+	0	0
22	Morse. Ibid.	M. 6 mos.	Gastric.	Vomiting.	Hands and feet.	Moderate	1 mo.	+	?	0	0
23	Morse. Ibid.	M. 4 mos.	Gastro-intestinal.	0	Arms, legs, and neck.	Slight.	4 mos.	+	—	0	0

[1] Reports of 6 cases by the following authors were not introduced by reason of the incompleteness of data no data); 1 case by Sailer in 1899 (no data); 1 case by Hand in 1900 (no data); 1 case by Hanna in 1902 (no

AMERICA FROM JANUARY 1, 1895, TO JANUARY 1, 1905.[1]

0 = not stated. ? = doubtful.

Sensory phenomena.	Unusual phenomena.	Reflexes.	Temp. (° F.), pulse, resp.	Urine.	Bowels.	Result.	Remarks.
No pain.	0	Normal	0	0	Normal.	0	No known cause; periodically she has 15 attacks daily.
Tenderness of hands and feet.	0	0	0	Normal.	Regular	Well	No gastrointestinal disturbance.
Tenderness of hands and feet.	Convulsion and death.	0	0	0	Diarrhœa and constipation.	Death	Two mild attacks; third severe; mild anæmia; one other child in the family had tetany,
Tenderness of hands and feet.	Œdema of hands and feet.	0	0	0	Constipation.	Well	History of vomiting.
Tenderness of hands and feet.	Œdema, erythema, laryngismus.	0	Fever.	0	Constipation.	"	One other child in the family had tetany at one year.
Slight pain.	Convulsive movem'nts, dyspnœa.	0	Normal.	Normal.	Diarrhœa and constipation.	"	Stools showed "intestinal fermentation."
0	Laryn'mus, trismus, convuls'ns.	0	0	0	Diarrhœa and constipation.	"	History of vomiting.
Pain and tenderness.	0	?	T. 100.5 P. 130 R. 29	0	Constipation.	"	
0	None.	0	0	0	0	?	Child lost sight of.
Pain.	Risus sardonicus, œdema and sweat of face and hands.	0	0	0	Diarrhœa and constipation.	Well	
0	0	0	0	0	Diarrhœa	"	
0	0	0	0	0	Diarrhœa	"	
0	0	0	0	0	0	"	Death four weeks later from meningitis without tetany.
0	0	0	0	0	Diarrhœa	"	
Pain.	Stupor, sweating, scaling of skin.	Exaggerated.	T. 100–104 P. 100 R. 40	0	0	"	
Pain.	Œdema of hands.	0	Fever.	Normal.	0	"	Neurotic diathesis; tetany was not benefited by circumcision.
Pain and tenderness.	Trismus, involvem't of eye muscles.	0	T. 101	0	Diarrhœa	"	
Pain, tenderness & hyperæsth.	Swelling and redness of ankles and wrists.	0	T. 101	Trace albumin.	0	"	Severe angina; tetany 14 days after onset; 1 prior attack at 1¼ yrs.
Tenderness	0	Exaggerated.	Normal.	0	Diarrhœa	0	No rickets.
No tenderness.	0	0	0	0	Diarrhœa	Well	No rickets; abdominal pain.
0	Laryngismus, cyanosis.	Normal.	0	0	Normal.	"	Another child also had tetany.
Pain.	0	Normal.	T. 100	Diminished.	Normal.	"	Stomatitis; phimosis.
Pain and tenderness.	Convuls'ns, laryngismus.	Exaggerated.	0	0	Diarrhœa	"	Vomiting, snuffles, and phimosis; no rickets.

or the probable unsuitability of the diagnosis: 1 case by Miles in 1896 (tetanus); 1 case by Reisman in 1899 data); and 1 case by Barsky in 1904 (no data). These would bring the total to 58 cases of tetany in children.

No.	Author and journal.	Sex and age.	Associated disease.	Prodromata.	Muscular spasm			Trousseau.	Chvostek.	Erb.	Hoffmann.
					Site.	Intensity	Duration.				
24	Morse. Ibid.	M. 10 ½mos.	Gastro-intestinal.	0	Arms, legs, neck, and back.	Severe.	10 mos.	+	—	0	0
25	Adams. Amer. Journ. Obstet., 1898.	M. 2 days.	Traumatism.	0	Hands and feet.	Severe.	5 dys.	0	0	0	0
26	Adams. Ibid.	M. 5 mos.	Erysipelas.	0	Hands.	Moderate	48 hrs.	0	0	0	0
27	Yarros. Chicago Med. Rec., 1898.	M. 16 mos.	Rickets.	0	Arms, legs, face, and left sterno-mastoid.	Moderate	3 mos.+	+	+	+	0
28	Davis. Ibid.	M. 15 mos.	Intestinal, rickets.	0	Hands and feet.	Slight.	3 mos.	0	0	0	0
29	Davis. Ibid.	M. 8 mos.	Intestinal, bronchitis, rickets.	0	Hands.	Slight.	3 mos.	0	0	0	0
30	Davis. Ibid.	M. 18 mos.	Intestinal, pneumonia	0	Legs, abdomen, and thorax.	Slight.	0	0	0	0	0
31	Hubbard. Bost. Med. and Surg. Journ., 1899.	M. 14 mos.	Intestinal, abscess.	0	Hands, feet, neck, and back.	Slight.	6 dys.	0	0	0	0
32	White. Ibid.	M. 3½ mos.	Rickets, coxa vara.	None.	Legs and feet.	Slight.	10 dys.	+	—	+	0
33	Morse. Ibid.	M. 7 mos.	Gastro-intestinal, rickets.	0	Hands and feet.	Moderate	1 mo.	+	—	0	0
34	Morse. Ibid.	F. 7½ mos.	Rickets.	0	0	Moderate	3 mos.	+	—	0	0
35	Morse. Phila. Med. Journ., 1901.	M. 1 mo.	Gastro-intestinal.	0	Arms and hands.	Slight.	2 wks.	—	—	0	0
36	Morse. Ibid.	M. 11 mos.	Gastro-intestinal, rickets.	0	Hands, feet, and back.	Severe.	24 hrs.	+	—	0	0
37	Morse. Ibid.	F. 8 mos.	Gastro-intestinal, rickets.	0	Hands and feet.	Moderate	7 dys.+	+	—	0	0
38	Morse. Ibid.	F. 11 mos.	Dentition.	Shaking of head.	Hands.	Slight.	14 dys.	+	—	0	0
39	Morse. Ibid.	M. 10 mos.	Otitis med., rickets.	0	Hands, feet, and trunk.	Severe.	7 dys.	+	—	0	0
40	Morse. Ibid.	M. 14 mos.	Gastro-intestinal, influenza.	0	Arms and feet.	Slight.	24 hrs.+	0	+	0	0
41	Morse. Ibid.	M. 7 mos.	Congenital syphilis, rickets.	Vomiting.	Hands and feet.	Moderate	3 mos.	+	—	0	0
42	McAlister. Arch. of Pediatrics, 1902.	F. 5 yrs.	Gastric.	0	Arms, legs, jaws, face, and back.	Moderate	6 wks.	+	0	0	0
43	Elterich, Ibid., 1903.	M. 14 mos.	Chronic enteritis.	0	Hands and feet.	Moderate	1 wk.	0	+	0	0
44	Masland. Amer. Med., 1903.	F. 2½ mos.	Intestinal, rickets.	Anorexia and languor.	Hands and feet.	Slight.	2 wks.	+	—	0	0
45	Barsky. Med. News, 1904.	F. 11 mos.	Acute bronchitis.	0	Arms and legs.	Moderate	Once.	+	+	0	0
46	Howard.	M. 6 mos.	Rickets (?)	Convulsions.	Arms and legs.	Moderate	15 dys.+	0	0	0	0
47	Howard.	F. 3½ mos.	Gastro-intestinal, rickets, abs. of scalp	Vomiting.	Arms, legs, and neck.	Slight.	10 dys.	0	0	0	0

Sensory phenomena.	Unusual phenomena.	Reflexes.	Temp. (° F.), pulse, resp.	Urine.	Bowels.	Result.	Remarks.
Pain and tenderness.	Opisthotonos, respiratory spasm.	Normal.	T. 99–100	0	Constipation.	Well	Vomiting; two other children died with tetany (?).
Pain.	0	0	0	0	0	"	Forceps delivery; circumcision and secondary hemorrhage.
Pain.	Convulsions.	0	0	0	0	"	Death 6 days later from pneumonia; no meningitis at postmortem.
Pain.	Laryngismus, sweating.	Exaggerated.	0	0	Constipation.	Unimproved	Measles three months before.
0	Laryngismus.	0	Normal.	0	Regular	Well	Italian child; stools pasty with undigested food.
0	0	0	0	0	Regular	"	Italian child; stools dark and offensive.
Restlessness.	0	0	T. 102	Normal.	Regular	"	Death ten months later from "convulsions."
0	0	Absent.	0	0	Diarrhœa	"	Rickets; phimosis.
Tenderness.	None.	Exaggerated.	Normal.	Normal.	Regular	"	Italian.
Pain.	Œdema of feet and hands, laryngismus.	Normal.	T. 100–101	Normal.	Diarrhœa	"	
0	Œdema of hands, convulsions, laryngismus.	Feeble.	0	0	Constipation.	0	
Pain.	0	Normal.	0	0	Diarrhœa	Well	
Pain.	Opisthotonos, purpura.	0	T. 39° C.	0	Diarrhœa	Death	
Pain.	0	0	T. 40° C.	0	Diarrhœa	?	Vomiting; mucus in stools and stomach washings.
0	Swelling of face, convulsions.	0	0	0	Normal	Well	
Pain.	Swelling of arms and legs.	0	T. 40° C.	0	Normal	Death	
0	Convul'ns.	Absent.	T. 99	0	Diarrhœa	0	Dentition.
Pain.	Convul'ns, laryngeal stridulus.	Absent.	0	0	Diarrhœa	Well	
Vertigo, irritability, tenderness, cold pains.	Cyanosis, trismus, unconscious.	Exaggerated.	T. 100.4 P. 120	0	Regular	"	Patient had been vaccinated, but had first attack one month before.
Pain.	Laryngospasm.	0	0	0	Diarrhœa	"	
Pain.	Swelling of hands and feet, anuria 20 hours.	Slightly increased	T. 98⅘ P. 120	0	Diarrhœa	"	Patient was a colored child; thyroid not enlarged; brother had tetany.
0	0	0	T. 102 P. & R. rapid	0	0	"	Tetany at onset of bronchitis.
Tenderness.	0	Exaggerated.	T. 100 P. 100–120 R. 28	0	Normal.	Unimproved	Colored child, lost sight of; hb. 75; r.b.c. 900,000; w.b.c. 11,600 to 6000.
0	0	Normal.	Normal.	Trace albumin.	Diarrhœa	Death	Colored child; hb. 50 %; r.b.c. 4,700,000; w.b.c. 8,600; death from asthenia; autopsy neg.

REVIEWS.

TRAITE DE MEDECINE OPERATOIRE ET DE THERAPEUTIQUE CHIRURGICALE. Publié sous la direction de PAUL BERGER, professeur à la Faculté de médecine, chirurgien de l'hôpital Necker, et HENRI HARTMANN, professeur agrégé à la Faculté, membre de la société de chirurgien de l'hôpital Lariboisiere. Chirurgie du système nerveux, crane et encéphale-rachis et moelle-nerfs. Par GEORGES MARION, professeur agrégé à la Faculté de médecine de Paris, chirurgien des hospitaux. Avec 320 figures dans le texte. Paris: G. Steinheil, editeur, 1905.

THIS volume, which is one of a series on "operative medicine and therapeutical surgery," published under the direction of Berger and Hartmann, is consecrated to the surgical treatment of affections of the skull, spine, brain, spinal cord, and nerves. In the first section one finds a collection of the various methods of craniocerebral topography; the technique of the different operations upon the cranium and brain, including the intracerebral injections of antitoxin and the operative procedures concerning the ventricals and subarachnoid space; and a series of chapters in which are considered the indications for, and the details of, the divers procedures used in the treatment of traumatisms, inflammations, new-growths, and finally miscellaneous affections--viz., epilepsy, microcephalus, hydrocephalus, spontaneous intracranial hemorrhages, and encephalocele. The second part comprises a section on spinomedullary topography; the technique of laminectomy, lumbar puncture, and epidural injection, and a study of the different affections for which these procedures are indicated. In this section are also considered the treatment of acute osteomyelitis of the vertebra and Pott's disease. In the third part are first discussed affections of the nerves for which operation may be necessary, and finally the technique of the various operations.

The whole surgery of the nervous system seems to be completely covered in a satisfactory manner.

Particularly complete among the chapters on technique are those concerning the methods for effecting entrance into the cranium and those detailing the methods of search for the various nerves, especially the trigeminal and the sympathetic. Although a large number of methods are given, the author clearly indicates the one he favors, together with his reasons.

We believe that the chapter on depressed fractures of the skull should be a little more radical, and that on fractures of the spine a great deal more radical. The indications for operation should be more sharply drawn in "*encéphalocèles*," according to whether the tumor contains cerebrospinal fluid alone or brain tissue. In the presence of a divided spinal cord the author advises that it may be sutured, although nothing will come of it. Suspension of a chloroformized child for the reduction of gibbosity by traction and moderate compression is advised. Primary suture of the severed nerves is not recommended, unless the ends are easily found, the author preferring to wait until healing of the wound in the soft parts has taken place, because of the more favorable results of secondary suture. In the treatment of facial neuralgia, prolonged medical treatment, especially with opium and antipyrin, is counselled before resorting to operation.

The illustrations, for the most part original, are numerous and clear. The text shows a vast amount of research in which the labors of the American surgeon have not been overlooked. The work will be of great value to the surgeon who, although daily invading the abdomen, has necessarily a very limited experience in most of the affections which the author has so admirably studied. It is the physician, however, who, even to a greater degree, needs to read a book of this sort in order to sufficiently appreciate the resources of the surgery of the nervous system. F. T. S.

MORPHOLOGY AND ANTHROPOLOGY. A HANDBOOK FOR STUDENTS. By W. L. DUCKWORTH, M.A., Fellow of Jesus College, Cambridge University Lecturer in Physical Anthropology; Correspondant Etranger de la Société d'Anthropologie de Paris. Cambridge: at the University Press, and the Macmillan Company, New York, 1904.

THIS handbook is one of the Cambridge Biological series under the general editorship of Arthur Shipley, M.A., F.R.S. It covers most of the original work done on this subject by the author, and is well illustrated by drawings and diagrams taken largely from his dissections of the anthropoid apes and aboriginal natives of Australia.

The opening chapter contains a brief but comprehensive historical review of the labors of Dr. Edward Tyson, Buffon, Lamarck, Blumenback, Camper, Darwin, Huxley, Broch, Tylor and others. The work contains chapters on mammalia in general and suborders of the primates—their anatomy, general and special, including dentition and embryology, anatomical variations, comparative

craniology and craniometry, osteology and morphology—recent and fossil.

His general conclusions are that the modern Simiidæ did not themselves figure in the ancestry of man, and that they are themselves specialized in a high degree—more specialized in many ways than man, and more specialized than their own ancestors.

The balance of evidence indicating that the line of human ancestry would, were the materials still available, be traceable down to the lowest primates, and even to the lowest mammals.

He places the advent of man back to the early Tertiary epoch. He agrees with Turner that the aborigines of Tasmania and Australia have furnished examples of the greatest concentration of apelike characteristics; although themselves remarkably specialized in adaptation to their surroundings.

He maintains that man holds a unique position among mammalia, through the specialization of the cerebrum, giving him an exceptional development of self-consciousness, ability to formulate, communicate, and record ideas, enabling him to adopt methods of self-preservation hitherto unattainable by any other organism. He prophesies survival, evolution, and development of populations of mixed origin, showing that the least mixed races, like the Australian, Negrito, and Eskimo, are diminishing in numbers and are doomed to early extinction.

The book is thoroughly scientific and scholarly, and may be looked upon as the most valuable contribution to this fascinating subject that has appeared in recent years. R. T. McK.

TRAITEMENT DES ANKYLOSES PAR LA RESECTION ORTHOPEDIQUE ET L'INTERPOSITION MUSCULAIRE. Par le DR. ALPHONSE HUGUIER, ancien interne lauréat des hôpitaux de Paris (Médaille d'argent, 1903), ancien aide d'anatomie à la Faculté de médecine. Paris: G. Steinheil, editeur, 1905.

THE treatment of complete, intra-articular ankylosis is notoriously unsatisfactory; forcible manipulations are not only useless but dangerous; osteotomy may correct a vicious position but does not give motion; while in certain situations resection may give motion but greatly weakens the joint. The monograph of Huguier deals with the treatment of these cases by the interposition of muscular tissues between the joint surfaces, a method which, although carried out as long ago as 1893 by Helferich, may still be called new. That the method is not impracticable the author proves by his collection of 32 cases, including the jaw, shoulder, elbow, wrist, hip, and femoropatellar articulations; in 30 of these cases the new joint persisted.

The brochure is divided into two parts. In the first part is found a brief reference to the history of the operative treatment of ankylosis, in which it appears that in 1826 J. Rhea Barton, at the Pennsylvania Hospital, was the first to practice osteotomy for this condition. The author demonstrates the superiority of fascia or muscular tissue over the various foreign bodies which have been from time to time proposed to prevent re-ankylosis after separation of the joint surfaces; and discusses the indications for operation, especially regarding the joint affected, the nature of the ankylosis, and the age of the patient.

In the second part is minutely detailed the operative technique for each articulation, the text being elucidated by suitable illustration. The work closes with a complete history of each of the cases collected from the literature together with the final results.

The subject is of intense interest to the surgeon and the book will stimulate further efforts in the direction indicated by the author.

F. T. S.

NORMAL HISTOLOGY AND MICROSCOPIC ANATOMY. By JEREMIAH S. FERGUSON, M.Sc., M.D., Instructor in Normal Histology, Cornell University Medical College, New York City. With 462 illustrations in the text, many in colors. New York and London: D. Appleton & Co., 1905.

IN this book the author has admirably succeeded in presenting the subject of normal histology in a lucid, full, and interesting manner. The book follows the logical plan for such a work, that of first presenting general considerations of cells and tissues, followed by detailed descriptions of the various systems and the organs forming them. The subject has been carried well up to the present time, recent work being extensively quoted. Throughout the book the more important references are given, and at the end an extensive bibliography is added, arranged to correspond to the chapters of the book.

Although the subject is perhaps more extensively treated than in any other text-book in English, it is entirely practical for the use of students. The illustrations are for the most part notably good. They are, as a rule, borrowed from other authors. The majority of the original illustrations are photomicrographs, which are quite unsatisfactory, and fail, except in low magnifications, to convey a clear idea of the tissue or organ represented.

The author's clear style, together with the attractive appearance and good printing of the book, make it pleasant reading. Tabulated *résumés* placed at the ends of the chapters should prove of use to the student. Considerable space has been allotted to the central

nervous system, which is well treated, while the last chapter contains a brief but satisfactory description of technique, in which all of the important procedures required in the study of histology are given.

Altogether the book gives the impression of being a careful, well-planned piece of work, and should find much use as a text-book and as a work of reference. G. C. R.

ECOLE MASSOTHERAPIQUE DE L'HOTEL-DIEU (Service de M. le DR. J. LUCAS-CHAMPIONNIERE). Massage des membres. Par le DR. DAGRON, ancien interne des hôpitaux, ancien aide d'anatomie à la Faculté. Avec 101 figures dans le texte. Paris: G. Steinheil, editeur, 1905.

DAGRON insists that massage should be performed by the physician and not by a nurse or non-medical masseur. He devotes a chapter to the generalities of *massothérapie*, carefully explaining the reason for and the technique of the various methods; or, as he prefers to say, the variations of the one method—*i. e.*, pressure modified as to its degree, direction, penetration, rapidity, etc., according to the indication. The only instrument advised is the hand, and the only lubricant fine talcum powder.

The simplicity expressed in the first part of the book is also quite evident in the second portion in which each of the large joints of the limb is studied with a view to massage. In the section on regional massage the author first gives a brief but sufficient review of the anatomy and physiology of the part and then the technique of massage of that particular region, together with the method of performing passive motion and the active movements which the patient should be advised to make. Next the diseases and injuries of each region are discussed with reference to massage and the indications and contraindications pointed out. Certain diseases involving the whole body are discussed under the extremity in which the symptoms are more particularly manifested, thus locomotor ataxia finds itself in the section on the lower extremity and progressive muscular atrophy in that on the upper extremity.

The surgeon will be especially interested in those sections treating of fractures. Massage from the very beginning is advised in all fractures except those of the patella, in which wiring is stated to be the method of choice. Massage and forcible passive motions are commonly employed after the healing of a fracture to strengthen muscles and limber joints. The school of Championniére use gentle massage and painless motions throughout the treatment for the prevention, rather than the cure, of these complications. Chopping

and forcing are never indicated, according to Dagron; "a muscle should be convinced and not conquered." It is also interesting to note that in cases of phlebitis passive motions are advised as soon as the temperature has become normal.

The text is illustrated with a number of cuts and will repay careful reading by the surgeon or the masseur. F. T. S.

CLINICAL HÆMATOLOGY: A PRACTICAL GUIDE TO THE EXAMINATION OF THE BLOOD, WITH REFERENCE TO DIAGNOSIS. By JOHN C. DA COSTA, JR., M.D., Demonstrator of Clinical Medicine, Jefferson Medical College; Hæmatologist, German Hospital, etc. Second edition, revised and enlarged, containing 9 full-page colored plates, 3 charts, and 64 other illustrations. Philadelphia: P. Blakiston's Son & Co., 1905.

THE demand for a second edition of this book has given the author an opportunity to bring forward the many advances that have been made in hæmatology in the last four years. This he has fully done, and the book is a thoroughly modern exposition of the subject. About 100 pages have been added in the second edition. These additions include discussions on trypanosomiasis, cyanotic polycythemia, blood changes in chloroma, pancreatitis, variola, and arthritis deformans, as well as a more extensive treatment of the bacteriology of the blood in several diseases.

The book contains a very large number of references, and since they are given wherever the literature is quoted the book should be of much use in tracing the original sources of the subject.

The classification and arrangement are for the most part excellent, although the consideration of Hodgkin's disease as one of the specific diseases of the blood seems hardly justified.

This volume represents a large amount of careful work and should prove of much value. G. C. R.

POSTMORTEM PATHOLOGY. A MANUAL OF POSTMORTEM EXAMINATIONS AND THE INTERPRETATIONS TO BE DRAWN THEREFROM. A PRACTICAL TREATISE FOR STUDENTS AND PRACTITIONERS. By HENRY W. CATTELL, A.M., M.D. Second revised and enlarged edition. Copiously illustrated with colored plates and figures. Philadelphia and London: J. B. Lippincott Co., 1905.

MANY additions have been made to this new edition, among which may be mentioned a chapter on the pathology of the bones and joints, a summary of the literature on legal medicine, and the

technique of postmortem examinations, and many new illustrations. The work is large, filling over 500 pages, and the minutest details of technique are carefully considered and frequently illustrated. All phases of the postmortem examination are duly considered, but usually with a suggestion of the medicolegal aspect. This side of the question is very carefully and rightly attended to, since the book is devised particularly as a guide for the practitioner and the coroner's physician. Following the consideration of each organ or group of organs there is a chapter giving an epitome of the various diseases affecting these organs. A chapter is also devoted to the diseases due to micro-organisms, parasites, and hæmatozoa. Other chapters treat of the restoration and preservation of the body, the preservation of tissues, bacteriologic investigations, weights and measures, and comparative postmortems. The book is excellently adapted to the needs of the coroner's physician and to the practitioner, of whom is frequently required a medicolegal knowledge. W. T. L.

A Laboratory Guide in Bacteriology. For the Use of Students, Teachers, and Practitioners. By Paul G. Heinemann, Sc.B., Fellow in Bacteriology, the University of Chicago. Chicago, The University of Chicago Press, 1905.

This little book of 130-odd pages differs from the usual type in that it is planned solely as a guide for practical work in the laboratory, and presupposes or indeed necessitates the use of a text-book or the benefit of a course of lectures. It may be readily understood how a student who enters the laboratory unfamiliar with the names or uses of the various apparatus, puzzled by numerous directions for media making, and uncertain about the preparation of his cultures, would find such a manual of much value. In the preface the author states that the course, as outlined, is almost identical with that given at the University of Chicago. The book is really a set of directions for the work in the laboratory. Each chapter takes up a definite topic, carrying the instructions from the elementary subjects of cleaning and sterilizing glassware and the preparation of culture media to the study of the various groups of micro-organisms. No descriptions of bacteria are given, for in most of the chapters dealing with the various groups of bacteria the student is referred for this information to original articles or good text-books. Between almost every page of the book a blank sheet is inserted for notes. A book such as this must facilitate very greatly the practical class work in bacteriology for which it is most excellently adapted. It is of course only intended to supplement a course of lectures or the study of a text-book and can only be used in the laboratory. W. T. L.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

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The Etiology of Syphilis.—Metschnikov and Roux (*Fortschr. d. Med.*, 1905, p. 559), Rille (*Munch. med. Wchnschr.*, 1905, Bd. lii. p. 1377), Rille and Vockerodt (*Ibid.*, p. 1620), Mulzer (*Berl. klin. Wchnschr.*, 1905, Bd. xlii. p. 1144), Kraus and Prantschoff (*Wien. klin. Wchnschr.*, 1905, Bd. xix. p. 941).

The above references are a few of the recent contributions to the interesting and important field opened by the communications of Schaudinn, a preliminary report of which was published on March 3, 1905. Schaudinn, working in conjunction with Hoffmann, examined primary lesions, condylomata, and then the juice from specific inguinal glands, and was able to demonstrate almost constantly the presence of a spirochæte which on account of its faintly staining properties he calls *spirochæte pallida* to distinguish it from a more easily stained form occurring in various non-specific lesions, *spirochæte refringens*. *Spirochæte pallida* varies from 4 to 14μ in length, averaging 7μ, and has a thickness of $\frac{1}{4}\mu$ and less. It has from 4 to 14 turns and is wound closely like a corkscrew in contradistinction to *spirochæte refringens*, which has wider, flatter, more wave-like convolutions. In fresh smears it displays rotation about its axis and bending movements. An undulating membrane has occasionally been seen but never flagella. They stain most satisfactorily in a modified Giemsa eosin and azure mixture. Schaudinn published positive findings in 7 primary lesions, 8 genital papules, 1 anal papule, 12 inguinal glands, and 2 unbroken skin papules. Of course it was very important to know if the same organism was present in experimental syphilis and Metschnikov, who had, at the time, a number of inoculated monkeys, was appealed to. His report shows that he found them in 4 of the 6 animals, and he lays no great weight

upon their absence in 2, as the distribution of spirochæte is very unequal. In one instance of five slides made from the same sore only one showed the organism. He found them also in 4 out of 6 human patients in the contents of fresh papules, occasionally numerous, but usually only a few present. Metschnikov points out that previous writers had suggested the possibility of a spirochæte being the cause of syphilis. Donne, in 1837, and Alvarez and Tanel, in 1885, referred to this. The organism they saw was without doubt *spirochæte refringens*, but Bordet and Gengou, in 1902, recovered *spirochæte pallida* from a primary lesion; after a number of subsequent failures, however, they did not follow up their observation. Metschnikov recognizes the organism of some of Bordet's old slides. In non-syphilitic lesions such as psoriasis and acne he was unable to demonstrate them and he concludes by saying that "taking everything into consideration the evidence points toward syphilis being a chronic spiralosis caused by the spirochæte of Schaudinn. In Germany, Paschen demonstrated the spirochæte in an initial lesion before the Hamburg Medical Society on May 2d, and on the 6th of May Buschke and Fischer published a fatal case of inherited syphilis in which they were found in the liver, spleen, and blood. Confirmatory reports since then are very numerous. Levaditi, Salmon, and Hoffmann found them in pemphigoid blebs, spleen, lungs, liver, and glands of inherited syphilitics. Schaudinn in the blood obtained by splenic puncture from an acquired case. Wechselmann and Loewenthal, Kraus, Volk, Lipschutz, and Ehrmann, Fraenkel, McWeeney and numerous others report positive observations. In 22 examinations of lesions in varied positions in 14 different cases Rille obtained positive results in all. Mulzer found the organisms in 20 out of 22 cases, and in examining further 29 patients with all manner of non-syphilitic lesions he found a spirochæte in only 8, and this could without difficulty be distinguished from *spirochæte pallida* by morphological and staining characteristics. Kraus and Prantschoff report 32 positive findings in the examination of 37 chancres; in 18 out of 25 syphilitic papules. Four inoculated monkeys all yielded *spirochæte pallida*, and this was true when the inoculation was conveyed from one monkey to another, as well as from man to monkey. *Spirochæte pallida* has been found with almost constant regularity in initial lesions, in inguinal glands, and in all varieties of secondary skin eruptions, less frequently in the blood, in the spleen, liver, and lungs, on the tonsils, in gummata, in nasal secretion, and in inoculated animals. Over 100 positive findings have been reported with but a small number of failures. In over 50 control investigations of various other diseases spirochætæ were found in but a few instances, and these could be identified as *spirochæte refringens*. Kislemenoglon and von Cube, however, have found spirochætæ in non-specific lesions, organisms which they assert resemble so closely *spirochæte pallida* that they are indistinguishable. One must of course be cautious, but such an overwhelming array of evidence is suggestive, especially when such men as Schaudinn, Metschnikov, and Roux point the way. To quote from Kraus and Prantschoff: "From our investigations we conclude that *spirochæte pallida* does not occur in the healthy tissue of man or monkey and not in tissues affected with other than syphilitic lesions. *Spirochæte pallida* can be found constantly in syphilitic lesions in man and monkey. From its constant occurrence in syphilitic lesions and its absence in healthy or otherwise

diseased tissues, one may assume with probability bordering on certainty that *spirochæte pallida* is the cause of syphilis in man and of experimental syphilis in monkeys."

Recent Advances in Our Knowledge of the Metabolism of the Purin Bodies.—Investigations of a recent date have developed the fact that specific organic ferments play a most important part in the metabolism of uric acid and the other purin bodies—adenin, guanin, hypoxanthin, and xanthin. We have known for a number of years that all five are the product of nuclein disintegration, but not until the publication of recent researches have we known where the various purin bodies are formed or how one becomes transformed into another.

The work of Jones and his associates, Partridge and Winternitz, in this country, and of Schittenhelm and Burian in Germany have shown that specific organic ferments play a vital part in the various stages in the formation of uric acid.

Thus, JONES and PARTRIDGE (*Zeitschrift für physiologisch Chem.*, Bd. xlii. p. 343) demonstrated that the thymus and adrenals contain an enzyme, guanase, which has the power of hydrolizing guanin into xanthin. This ferment is not contained in the spleen.

Subsequently, JONES and WINTERNITZ (*Ibid.*, Bd. xliv. p. 1) showed that the thymus, adrenals, pancreas, and liver contain another enzyme, adenase, which is capable of hydrolizing adenin into hypoxanthin.

Further, SCHITTENHELM (*Ibid.*, Bd. xlii. p. 251; Bd. xliii. p. 228) demonstrated that the liver, lungs, spleen, and muscles contain a ferment which oxidizes xanthin into uric acid. He finds that it is not contained in the thymus, intestines, blood, or kidneys. Burian has given this ferment the name "xanthin oxidase."

Another important fact has been demonstrated, namely, the existence of a specific intracellular enzyme called nuclease, which has the power of liberating the purin bases from their combinations as component parts of ingested or tissue nucleoproteids, or more particularly from their contained nucleic acid. Thus, after the purin bases guanin, adenin, hypoxanthin, and xanthin have been set free by the nuclease, the ferments guanase, adenase, and xanthin-oxidase are enabled to act on them and by hydrolysis and oxidation to convert them step by step into uric acid. Schittenhelm has also shown that there is still another tissue, oxidase, present in the kidneys, liver, muscles, and possibly the bone-marrow, which has the power of further oxidizing uric acid and consequently destroying it.

BEEBE (*American Journal of Physiology*, vol. xii. p. 13) has demonstrated that in man the ingestion of alcoholic fluids with purin containing foods increases at once the output of uric acid in the urine. Alcohol, however, does not produce the result when taken with a light diet or one free from purin compounds. In other words, alcohol influences only the uric acid of exogenous origin in conformity with the well-known gouty tendencies of high proteid feeding combined with the consumption of alcoholic fluids.

CHITTENDEN (*Boston Medical and Surgical Journal*, August 17, 1905, p. 179) points out that alcohol is well known to interfere with the oxidative processes of the liver, and it is more than probable that its influence on the uric-acid content of the blood lies in the direction of inhibiting the action of the oxidase which, present in the liver and other tissues,

normally destroys or oxidizes a certain proportion of the uric acid formed.

The important part these various enzymes have been shown to play in the intermediary metabolism of the nucleoproteids offers us some hope that we may eventually reach a satisfactory explanation of the metabolic disturbances causing gout.

SURGERY.

UNDER THE CHARGE OF

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Subdiaphragmatic Transperitoneal Massage of the Heart as a Means of Resuscitation.—GRAY (*Lancet*, August 19, 1905) records a case of apparent death from laryngeal obstruction due to cancer, in which resuscitation by the above method was accomplished. While the patient was still making a feeble, choky inspiratory effort, the writer performed a high tracheotomy with a penknife, the lips of the wound being retracted by bent hairpins. Artificial respiration was of no avail. The pulse and cardiac impulse stopped. She was pallid and all reflexes had disappeared. The pupils were widely dilated, the muscles absolutely flaccid, the lips pale, and the eyes rapidly assumed a "glassy" look. Various methods of resuscitation, including attempted external massage of the heart, were carried out, but all to no purpose.

Upon opening the abdomen with a penknife, the heart was compressed between two fingers introduced under the diaphragm and the ribs in front. Massage by the intermittent method was carried out for four minutes, when the heart showed signs of life: first by an increasing firmness, then a slight tremor, and soon a rhythmic beating (30 to 40 a minute) was present. The patient lived for fifteen hours afterward. Probably at least ten minutes elapsed between the times when the heart stopped beating and when it began again.

Two Cases of Glanders.—GOODALL (*Lancet*, August 26, 1905) lays particular stress on the diagnosis. Each was sent to the hospital as a case of typhoid fever, which, he thinks, was unjustifiable in both instances. The periostitis and intramuscular abscesses of the first case are rare in the acute stage of typhoid fever. The second case simulated acute rheumatism very closely. Arthritis is very rare in typhoid fever. The man's occupation, stableman, suggested glanders, and hence a bacteriological examination was made. Toward the termination of

the case the more characteristic symptoms of glanders appeared. Both cases illustrate the value of bacteriology as an aid to diagnosis.

In neither case was the exact source discovered. There were twenty-four horses in the stable in which Case II. was employed. Though some of these animals were ill, not one presented signs of glanders or reacted to mallein. There had been a case of equine glanders in the stables about a year before the patient was infected.

A New Operation for the Production of an Alimentary Gastric Fistula (Pylorostomy).—LAMBETTE (*Annales de la belge de chirurgie*, September, 1905), after a large experience with the operation of gastrostomy for œsophageal stenosis, has been disappointed with the various operations now in vogue. In 3 cases of cancer of the œsophagus he has performed cervical œsophagostomy with the introduction of a permanent tube through the stricture. His experience with this procedure was also disappointing.

He calls attention to the fact that frequently in these cases there is associated a simple stenosis of the pylorus. Cancer of the œsophagus occurs, especially in old alcoholics in whom the stomach is in very bad condition. This leads to spasmodic stenosis of the pylorus, which explains the acid regurgitation, so common in alcoholism. This can be indirectly the cause of the œsophageal stenosis, and explains the difficulty in obtaining a continent gastric fistula.

These considerations suggested the idea of employing the pyloric sphincter as the artificial fistula and of establishing a gastroenterostomy to assure the evacuation of the stomach.

The operation is divided into four stages: 1. Laparotomy. 2. Section of the duodenum and closure of the lower end. 3. Posterior gastroenterostomy. 4. Closure of the abdomen with fixation of the pyloric opening in the lower angle of the wound.

The fact that this operation is a little long in debilitated patients is not very important. It can be performed in twenty-five to thirty minutes, and there is no loss of blood. It can be done under local anæsthesia, which permits resort to immediate feeding. The new fistula is perfectly continent, since it is furnished with a powerful sphincter. In spite of this, it is sufficiently large to admit the index finger, and permits every kind of alimentation. The wearing of an apparatus is practically useless, since an ordinary belt is sufficient to guard the artificial mouth. Lambette has tried this method twice. The first patient operated on *in extremis* succumbed to a kinking of the jejunal flexure; the second was absolutely successful.

Contribution to the Study of the Treatment of Wounds of the Ureter in the Course of Surgical Operations.—BERNASCONI and COLUMBINO (*Annales des maladies des organes genito-urinaire*, September 15, 1905) call attention to the increasing importance of the surgery of the ureter. They conducted a series of experiments on dogs to show the feasibility of ureteroureteral anastomosis. The literature shows that this had already been done, but that the results had been unsatisfactory.

The writers believe that they are the first to succeed with the operation experimentally. They first performed the anastomosis in the pelvis near the bladder. This was done in 8 dogs, 3 dying of peritonitis, the 5 other cases being perfectly successful. The anastomosis was

then performed higher up in 2 dogs, in the region where it would be indicated in wounds of the lumbar and iliac portions of the ureter. The first dog died of peritonitis eight days after the operation, but the anastomosis showed good union and did not permit urine to escape. The second was very successful and gave an excellent result.

The operations were repeated on the cadaver and the technique is fully described, the operation consisting of four stages. The first stage includes the opening of the abdomen, the turning aside of the intestines and keeping them free of the field of operation by gauze pads, and the exposure of the desired portion of the ureter by a median incision of the posterior parietal peritoneum over the lumbar promontory. In the second stage the edges of the divided peritoneum are turned aside and the ureters exposed, taking care to avoid the numerous vessels nearby. In the third stage the portion of the injured ureter to be anastomosed is carefully freed from its peritoneal covering and carried across the median line to a position parallel to the opposite ureter. The divided end of the injured ureter being closed by a ligature, the two are held together by two stitches. The anterior surface of each is then incised longitudinally and the two openings sutured by their edges, first posteriorly and then anteriorly, thus completing the anastomosis. The fourth stage consists in closing the abdominal wound usually without drainage.

The writers reach the following conclusions:

When during an operation the ureter is accidentally wounded the injury can be remedied by different operative procedures, according to the nature, location, and seat of the traumatism.

When it is located some centimetres from the bladder the surgeon can draw down the ureter easily for 3 or 4 cm. and implant the upper cut end into the bladder.

When the injury is located higher in the lumbar or iliac portion of the ureter two conditions may be present.

(*a*) Simple division without loss of substance or with slight loss of substance. In this case the two cut ends can be united by an end-to-end anastomosis (Poggi) by a terminolateral anastomosis (van Hook), or finally by a laterolateral anastomosis, which is the operation of choice.

(*b*) Division of the ureter with loss of substance, making the end-to-end coaptation impossible. In this case, according to their experimental results, the writers believe that the laterolateral anastomosis of the two ureters is to be preferred to the opening of the wounded ureter on the skin surface or into the intestine. It is an easier operation than ureteroenterostomy, and is particularly simple in the female at the level of the fourth or fifth lumbar vertebra.

Aneurysmal Dilatation of the Right Subclavian Artery, the Innominate, and the First Part of the Common Carotid.—BARLING (*Lancet*, September 16, 1905) calls attention to the much better results obtained at the present time from arterial ligature than years ago. This is due to the improvement in wound treatment and the provision of better material for ligatures. In this case distal ligatures were applied to the first part of the axillary artery and to the middle portion of the common carotid artery. The results were excellent. Barling's experience with the proximal ligature has also been very satisfactory.

Clinical Effects of Ether Anæsthesia on Renal Activity.—PRINGLE, MAUNSELL, and PRINGLE (*British Medical Journal*, September 9, 1905) found by investigation on a series of patients operated on that during the time of full anæsthesia not only is the amount of urine reduced, in some cases as low as 3.6 per cent. of the normal, but the nitrogenous constituents are diminished to such an extent (2.2 per cent.) as to amount to practical suppression. This condition of renal inactivity appears to increase the longer the anæsthetic is continued.

THERAPEUTICS.

UNDER THE CHARGE OF

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Marrow in Treatment of Pernicious Anæmia.—DR. MENEFRIES reports the case of a woman afflicted with pernicious anæmia, in whom the red cells were increased from 680,000 to 3,000,000, and at the same time the symptoms attributable to her anæmia were removed by marrow opotherapy alone. The favorable effect of the marrow, in the author's opinion, was due to the fact that the patient exhibited a marked myeloid reaction (5 per cent. myelocytes). While quite important in other varieties of pernicious anæmia, this form of opotherapy is always indicated in this disease when even a slight myelæmia is present.—*La semaine médicale*, 1905, No. 15, p. 175.

A New Uric Acid Solvent.—MR. ROBERT FENNER states that the administration of thyminic acid in tablets of 4 to 7 grains, three times a day after meals, quickly cuts short the inflammatory stage of acute gouty conditions, and its prolonged administration has resulted almost invariably in marked improvement of chronic states, such as gouty glycosuria, eczema, gravel, and obesity. The drug is an amorphous brownish-yellow powder, almost tasteless, and soluble in cold water; in solution it has no incompatibles, and no toxic symptoms have been noted following its use. It has the property of holding in solution practically its own weight of uric acid at a temperature of 20° C. (68°), and this property is increased by 50 per cent. at body temperature.—*Lancet*, 1905, No. 4270, p. 19.

Alcohol Injections in Trifacial Neuralgia.—DR. OSWALT employs alcohol at 170°, in doses of 15 to 3 minims, to which about $\frac{1}{4}$ of a grain of cocaine has been added, to make the puncture less painful and the postoperative discomfort less severe. The alcohol should be injected

along the nerve trunks at their exit from the skull or in the canals which they traverse. When necessary a curved needle is used. When the inferior maxillary division is involved the injection should be made at the foramen ovale; when the superior maxillary division is affected, at the foramen rotundum. If the ophthalmic division is the seat of the neuralgia, the puncture is made by means of an infraorbital incision to the orbital plate. A tingling sensation felt by the patient shows when the injection reaches the nerve. Properly performed, the treatment is well borne, only slightly painful, and, as a rule, followed by benefit. The author's cases have been cured after three injections, but too short a time has elapsed to assert that permanent relief has been secured.—*La semaine médicale*, 1905, No. 22, p. 257.

Recent Hypnotics.—Dr. A. Maass discusses veronal, isopral, and neuronal. Certain individuals seem to possess an idiosyncrasy for the first of these, in consequence of which the slumber produced is disturbed and does not seem to be restful, but in general, the advantages of this drug more than counterbalance its disadvantages. Isopral acts well in small doses, but if taken on an empty stomach is likely to disturb digestion. It depresses the activity of the heart and consequently should not be administered to patients with nervous or mental affections. Neuronal, on account of its considerable content of bromine, is particularly active in conditions of mental excitation and confusion, and is a valuable addition to the list of hypnotic drugs. In the author's opinion, the perfect hypnotic is yet to be found; some of those which we already have being impossible of employment hypodermically, while others produce evil after-effects; but we have drugs which act similarly to chloral which are much less toxic.—*Berliner klinische Wochenschrift*, 1905, No. 14, p. 400.

The Effects of Intravenous Injections of Ergot upon the Circulation.—Drs. Torald Sollmann and E. D. Brown draw the following conclusions from a series of experiments upon mammals: The typical effects of the intravenous injection of ergot consist in a considerable and abrupt fall of blood pressure, followed by a prompt recovery and generally by a slight and short rise. The volume of the organs varies generally in the same direction as the blood pressure. The changes in the latter are mainly cardiac. Ergot causes first a lessening and then an increase of the cardiac excursions; the rate of the heart is but little altered. The effect of ergot must be exerted directly on the heart muscle. Ergot seems to have a slight, but inconstant vasoconstrictor action. The preliminary fall of blood pressure is absent if the drug is given by intramuscular injection. The action of ergot is independent of the dose within wide limits. Large doses depress the vagus centre and the vasomotor endings. It is not acutely fatal, even in very large doses. With regard to the therapeutic bearing of their results, the authors state that their experimental material contains no item which would point to ergot as a useful drug for modifying the general circulation. The reputed rise of blood pressure is too small, and particularly too short to have any significance. It fails most completely in conditions in which the blood pressure is low.—*Journal of the American Medical Association*, 1905, No. 4, p. 229.

The Treatment of Fatty Heart.—Drs. H. Huchard and C. Fiessinger believe this condition to be curable by a system of diet regulation. Dechloridation is necessary, consequently the following regimen is prescribed. Breakfast: cold, lean meat, about 2 to 4 ounces; bread without salt, 2½ drachms; at midday, roasted meat, 2 to 4 ounces; fresh vegetables, cooked in water with a little salt, 1 ounce; two cups of hot weak tea without sugar; at 4 o'clock, a cup of tea; at 7 in the evening, two eggs without salt; vegetables cooked in water, and bread without salt, 1 ounce; weak tea. Diuresis may be produced by 7½ grains of theobromine three times a day. After four or five weeks the diet may be less meagre, but not more than 5 ounces of bread may be taken; butter on the vegetables, wine diluted with water, and a vegetable soup at the evening meal may be allowed. If the fluids are suppressed, arterial pressure will be lessened and the restricted diet will be better borne. In obese persons who are plethoric and have a feeble heart, there is usually venous stasis, and if the labor of the heart is increased by the ingestion of considerable quantities of fluid the heart will be still further weakened. By restriction of the diet the labor of the heart is made more easy, the organ beats more forcibly and disembarrasses itself of the fat which interferes with its functions; as the patient loses fat his hypertension lessens, and the increased power of his heart action disposes of the venous stasis. The authors conclude that in cardiac cases whose weight is above normal, this regulation of diet will often accomplish wonderful results.—*Journal des praticiens*, 1905, No. 13, p. 201.

Eumydrin in Gastric and Intestinal Conditions.—Dr. G. Haas considers this substance useful in functional and secretory neuroses of the alimentary tract, such as hyperchlorhydria, gastralgia, intestinal spasm, perityphlitis, etc., and in all conditions of the stomach and intestines in which belladonna or atropine is indicated. Eumydrin is atropine, methylnitrate, a white, crystalline powder, easily soluble in water and alcohol; it is much less toxic than atropine. No tolerance or disagreeable effects are produced by it, even in large doses. Its dose is $^1/_{60}$ to $^1/_{15}$ of a grain three or four times a day, and it may be prescribed in pill, powder, solution, or suppository.—*Thérapie der Gegenwart*, 1905, No. 3, p. 105.

Baths in Gout.—Dr. Eduard Weisz states that unless the urine of a gouty patient contains more uric acid than that of a normal person, it is evident that the eliminative function of the kidneys is not sufficient and consequently measures are necessary to increase uric acid excretion, both through the kidneys and the skin. The best of these are mud or sulphur baths. The temperature of these is of no more importance than is their composition or density, and all these factors should be specially adapted to the patient in hand, for although cases may seem to be exactly similar, it is necessary to vary the treatment according to its effect upon the case. Acute exacerbations occurring during a course of bathing show that the treatment has been too energetic. The physician should proceed slowly and remember that the hotter the bath the more acute is the local reaction. Bathing should be begun directly after the acuity of the attack is past. Tepid applications should be made during the night to the affected part and at a temperature not higher than that of the skin. The baths should be begun at about 93°

and gradually increased during the first week to 106°, which temperature should not be exceeded in chronic cases, and the duration of the baths should be the shorter, as the case is more acute.—*Therapeutische Monatshefte*, 1905, No. 6, p. 292.

Heat and Cold in Articular Rheumatism.—Dr. Eduard Weisz advises against the use of local applications during the acute stage because of the pain which is induced by moving the limb. If the joint is red the ice coil is indicated, the water being at 53.5°; cold wet compresses, changed about every five minutes, are also useful when the congestion is marked. Swelling is not influenced by cold, but the pain is often favorably affected. If cold applications do not cause an amelioration of the acute symptoms heat should be employed; a temperature 10° above that of the body is not extreme. The heat hastens the recovery, once the acute stage is past, in a remarkable manner, and is also useful in the subacute stage, diminishing both the pain and swelling. In chronic cases the energetic employment of heat is almost a specific, although results may be delayed; chronic cases may also be treated by cold applications, especially after a hot season, in order to increase the tonicity of the nervous and muscular systems and to accustom the skin to variations in atmospheric temperature. In a word, cold should be relied upon in acute cases, heat in those of chronic type.—*Blätter f. klinische Hydrotherapie*, 1905, No. 5, p. 106.

An Antiseptic, Hæmostatic, and Analgesic Ointment.—Dr. Paul Reclus recommends the following formula, which may be modified to suit special purposes: Antipyrine, 5 parts; boric acid, 3 parts; salol, 3 parts; iodoform, 1 part; crystalline carbolic acid, 1 part; mercuric bichloride, $\frac{1}{20}$ part; petrolatum, 200 parts. If the odor of the iodoform is unpleasant, iodol may be substituted; in very painful wounds 3 to 5 parts of orthoform may be added; this may, however, prove irritant to the skin. The ointment is an excellent application for punctured, incised, and contused wounds and burns. It is excellent in chilblains and frost bites. The treatment recommended for the latter consists in immersing the affected parts twice a day in very hot water for ten minutes, then dressing them with the ointment spread upon gauze. The preparation is also useful in varicose and simple ulcers, bone sinuses, and after such operations as those for circumcision, hemorrhoids, and fistulæ. Irritation of the skin may follow its use, and in this case dressings moistened with sterile water should be applied. The ointment is apt to decompose, and consequently should be used only when fresh.—*Journal des practiciens*, 1905, No. 25, p. 385.

Serum Therapy in Erysipelas.—Dr. J. C. Ayer reports results in 33 patients suffering from erysipelas treated by serum. Of these cases 3 died —1 of the disease, 1 of pneumonia, 1 of wet brain. The author regards the administration of the serum after the third day of the disease as useless, consequently all the reported cases received the treatment on or before this day. The average duration after treatment was 6.8 days. The initial leukocytosis was high, falling on the day of desquamation to about normal. Albuminuria was present in 40 per cent. of the cases, but in over half of these disappeared by the second day after receiving the serum; 32 of the cases were of the facial type, and in comparing

these cases and 15 others previously reported with 79 cases treated by older methods, the author concludes that the shortening of the course of the disease by 2.6 days expresses the value of the serum treatment. The general amelioration of all the subjective symptoms is also in its favor, as well as is the apparent beneficial effect on the febrile form of albuminuria, which is so often present.—*Medical Record*, 1905, No. 1816, p. 341.

Doyen's Anticancer Serum.—M. DOYEN'S serum prepared from the *micrococcus neoformans*, which organism is, according to him, the cause of cancer, has been investigated by a committee appointed by the La Société Francaise de Chirurgie. A series of 26 patients in various stages of the disease was collected from his clinic and was observed at regular intervals while under treatment. The report returned by the committee was entirely unfavorable, no amelioration in any of the cases having been observed. It is possible that at the next meeting of the society the author will have something to say in justification of his treatment.—*La quinzaine thérapeutique*, 1905, No. 11, p. 239.

Hot-water Irrigations in Gonorrhœa.—DR. B. NARICH advocates hot water rather than antiseptics in gonorrhœal urethritis, since, in his opinion, the latter are likely to prolong the inflammation. His technique consists in irrigating the urethra with tepid water, gradually increasing its temperature until 111° is reached. A soft catheter is used and two irrigations daily of 2 quarts each or 4 of 1 quart are given.—*Progrès médicale*, 1905, No. 26, p. 409.

The Serum of Convalescents from Erysipelas in the Treatment of the Disease.—DR. L. FORNACA has treated 9 severe instances of facial erysipelas thus: The blood injected was taken from patients just recovering from the disease and who had been treated by ordinary methods, except in 1 case, when blood from a patient treated by the serum was used. The dosage varied, being usually 150 to 450 minims at a time, the entire quantity being from 300 to 10,500 minims; in 1 case a single dose of 750 minims was given. The results of the treatment were encouraging; after the injection there was a marked amelioration of the patient's general condition, the appetite returned, the headache and mental symptoms became less marked; albumin and casts, if present, disappeared from the urine. The effects of the serum on the temperature were variable. In 3 cases the temperature fell to normal on the day after the first injection; in 2 others this occurred after the second injection; in a third after three injections, and in the 3 other cases there was no noticeable effect upon the febrile movement. The local condition was not at all modified by the treatment; no unpleasant effects occurred, nor was recurrence noted.—*La semaine médicale*, 1905, No. 30, p. 354.

Moebius' Antithyroidine in Exophthalmic Goitre.—DR. A. ALEXANDER, in discussing this subject, states that the variety of modes of treatment that have been employed in this disease is due to the fact that its pathogenesis is so little understood. Moebius' hypothesis is that the condition is the result of qualitative and quantitative alterations

in the gland substance, and on this ground he proposes partial thyroidectomy and a specific treatment by means of a serum from thyroidectomyzed goats. He reports an improvement in 3 patients treated by this serum. The nervousness was rendered less marked and the insomnia became controllable without the use of hypnotics. Each patient gained about six pounds in weight within a few weeks. Moebius' serum neutralizes the products of disordered thyroid secretion, which cause the destruction of the fatty and albuminoid substances of the body. In each instance the thyroid gland decreased in size and became less firm in consistency, and the nervous manifestations were greatly ameliorated. In 2 of the patients the exophthalmos entirely disappeared, and in 1 the tremors were wholly relieved. The cardiac arrhythmia also disappeared and did not return upon cessation of the treatment. If the tachycardia returns after the medication is stopped, the author states that digitalis may be employed to advantage and baths of carbon dioxide gas are recommended. The ordinary dosage of the serum is from 6 to 12 drachms. If after this quantity has been administered the symptoms should recur, this dosage may be repeated. The serum usually causes no disturbance, but very large dosage has resulted in the production of a mild myxœdema.—*Münchener med. Wochenschrift*, 1905, No. 29, p. 1393.

The Roentgen Ray in Leukæmia and Pseudoleukæmia.—Drs. Arthur Holding and Mortimer Warren have reviewed the literature upon this subject, which shows that 25 cases of splenomyelogenous leukæmia treated by the *x*-ray have been reported, 8 of which have been symptomatically cured, 15 improved, 2 unimproved or fatal; that 8 cases of lymphatic leukæmia have been reported, none having been cured, 3 improved, 5 unimproved or fatal; that 22 cases of pseudoleukæmia have been reported, none having been cured, 3 improved, 5 unimproved or fatal; that 22 cases of pseudoleukæmia have been reported, 6 of which have been symptomatically cured, 13 improved, and 3 unimproved or fatal. The authors state that while these figures are based upon too few cases to be conclusive, they are rather remarkable in diseases recovery from which has been very rare. The technique employed in treating leukæmia and pseudoleukæmia by the *x*-ray consists in applying the light over the spleen, the enlarged glands, chest, knees, and elbows. The tube must be so excited as to give a light penetrating enough to reach the diseased organs. A low vacuum tube expending its energy upon but not penetrating the skin is to be avoided, this being the type of light which produces burns. Medication with quinine, fluorescein, and other substances, with the intent of increasing the fluorescence of the tissues, may be given as an adjuvant when it does not interfere with more important medication. The authors report 2 cases with the idea of calling attention to the marked action of the *x*-ray upon the lymphatic system and blood-making organs, of demonstrating the palliative action of this method of treatment in leukæmia and pseudoleukæmia, of suggesting that in some cases we may hope for cure, and of stimulating further observation and research.—*New York and Philadelphia Medical Journal*, 1905, No. 20, p. 1001.

Creosote Carbonate in Tuberculous Mesenteric Glands.—Dr. Hecht considers this condition by no means hopeless if rational and persistent

treatment is instituted in the early stages. The treatment recommended by him consists in the employment of warm compresses and inunctions of green soap, together with the administration of creosote carbonate, the action of which is as favorable in tuberculosis of the mesenteric glands as in analogous inflammations of the cervical and brachial glands. A child of ten years may receive from 5 to 10 drops three times a day.—*Die Therapie der Gegenwart*, 1905, No. 4, p. 108.

OBSTETRICS.

UNDER THE CHARGE OF
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Sudden Death during or Immediately after the Termination of Pregnancy or Operation on the Pelvic Organs in Women.—At the last meeting of the American Gynecological Society, DAVIS (*Surgery, Gynecology, and Obstetrics*, July, 1905) reports 3 cases of sudden death; 1 after abortion, 1 after delivery by forceps, and 1 after hysterectomy with the removal of the tubes and ovaries.

The case of abortion had been criminal, and the patient was seen in consultation some time afterward with a retained placenta. This was removed under ether, the uterus irrigated and packed. The patient died during operation, and autopsy revealed no cause.

A primipara who had been subjected to great mental strain during pregnancy had also suffered from grip with chronic bronchial catarrh; elimination had been badly performed. Fourteen hours after the first sign of labor, while the patient was in good condition, the fetus had descended to the pelvic floor and rotation was partially complete; the patient complained of suffering, and took 4½ ounces of Squibb's ether from a freshly opened can, administered by dropping upon gauze. The pulse did not rise over 90 and was of good quality. Shortly after the delivery of a large male child by forceps and the removal of the placenta, the patient had a respiratory spasm with persistent action of the heart. Forty-five minutes after this respiratory failure was complete and cardiac failure ten minutes later. An autopsy could not be obtained, but the symptoms were those of pulmonary embolism.

His third case was that of a neurotic woman, who, some years previously, had a difficult labor with infection and lacerations. During a rest cure she was taken with thrombosis of the left lower extremity, with nephritis and pelvic peritonitis; thrombosis also extended to the right side. From this the patient recovered in two months, and was then in good general condition. She requested operation to avoid the danger of repeated attacks.

On opening the abdomen some adhesions between the uterus and surrounding tissues were broken up; there were evidences of previous infection on the left side of the uterus; the ovaries were cystic, and the tubes showed evidence of chronic infection. The body of the uterus,

tubes, and ovaries were removed without hemorrhage and shock. The patient developed rapid pulse after the operation, but improved. Forty-eight hours after operation she died suddenly on awaking from sleep. On autopsy pulmonary embolism was present and had caused death.

In 18,800 women in childbirth or after operation, 30 cases of immediate pulmonary embolism were reported, with a mortality of 73.33 per cent.

Pulmonary embolism may also be secondary to a primary thrombosis; this is not unusual, and is frequently preceded by a progressively rapid pulse, while the temperature of the patient may fall to normal. This rapid pulse, known as Mahler's sign, was present in 63.33 per cent. of cases.

Regarding the causation of immediate pulmonary embolism, no satisfactory explanation can be given which can be traced to any one manipulation, nor to any one stage of labor. Those patients who have had pulmonary infections during pregnancy or who have had disease of the bloodvessels before labor or operation are most liable to its development. The most severe cases of labor frequently escape death in this form.

So far as the treatment of pulmonary embolism goes, it consists in putting the patient at absolute rest and giving stimulants promptly. Where thrombosis precedes, much can be done to avoid the accident by keeping the patient perfectly quiet.

The author, from cases reported in 193 papers, aggregating 125 cases, compiled a table of 25 typical cases, which is appended to the original paper.

Intrauterine Movements of the Thorax and the Diaphragm. Intrauterine Breathing.—AHLFELD (*Monatsschrift für Geburtshülfe und Gynäkologie*, 1905, Band xxi., Heft 2) describes what he terms intrauterine fetal breathing. He finds mention of this by several authors in the literature of obstetrics.

Personally he has repeatedly observed upon inspecting the abdomen of a woman in the last months of pregnancy, and by practising palpation, not only the usual movements of the lower extremities and the trunk, but also an involvement of the fetal thorax, which is not to be confused with the aortic pulse of the mother. This fetal movement is wave-like in character, and, when a tracing of it is taken, it resembles that of the respiratory movements in the newborn child. These movements occur frequently at regular periods, followed by a short pause. These movements vary in number from 38 to 76 in the minute, making an average of 61. By comparing the curve of these fetal movements and that of the mother's aortic pulse, they are seen to be widely different in frequency and also in character. They may also be distinguished from the respiratory movements of the mother. They are readily recognized as distinct from her uterine contractions. If the newborn child when placed in a bath of warm water be closely watched, he performs similar thoracic movements. The relation existing between inspiration and expiration in the child after birth and the same phenomena in fetal respiratory movements are found to be almost identical. In some cases where the child lies in the uterus with the thorax anterior, these movements may be studied with especial clearness.

Evidently if the fœtus makes inspiratory movements while within the

uterus, its nostrils must contain at birth amniotic liquid. If the contents of the fetal nostrils be removed by a glass tube so soon as the head is born, and the fluid thus obtained be examined, it is found to be amniotic liquid. Ahlfeld also reports the case of two full-term children, born living after a short labor, with no symptoms of asphyxia, both of whom had congenital stenosis of the œsophagus, with a communication between the œsophagus and the trachea. These children perished four days after birth. Upon examination the meconium was found full of fine lanugo hairs. There can be no rational explanation of this, except that the fœtus regularly performed movements of respiration which admitted amniotic liquid to the trachea and through a communication to the stomach and intestine.

Ahlfeld also has observed short and rapid movements of the thorax, which may be demonstrated by appropriate apparatus. He concludes from these observations that the fœtus in utero performs respiratory movements frequently, and probably in all cases of full development.

Pelvic Deformity in 30,000 Labors.—TAYLOR, registrar at the Lying-in Hospital at New York, reports in the *Bulletin* for June, 1905, the results of labor in contracted pelvis in 30,000 patients. The mortality for children, including stillbirths, was 37 per cent. There were 11 cases of prolapsed cord and several cases of macerated fœtus. The number of mothers having deformed pelvis requiring operation for delivery in 30,000 labors was 269; 204 of these were delivered by forceps or version. The mortality of the mothers was 8, 2 died after Cæsarean section, 2 had rupture of the uterus, 2 septic infection, 1 hemorrhage and shock, and 1 uræmia.

Study of these cases seems to show that in cases of moderate pelvic deformity, where engagement fails and the membranes are intact or but recently ruptured, version offers a better result than the high application of the forceps.

Pubiotomy.—HOHLWEG (*Zentralblatt f. Gynakologie*, 1905, No. 42) reports 4 cases of pubiotomy from the clinic at Kiel. The operation was performed in the usual manner by cutting down upon the bone and severing it with a Gigli saw. Delivery was effected by forceps in some cases and in others by version. Considerable hemorrhage was experienced, which was controlled by packing with iodoform gauze, which was used as a drain. One case terminated fatally in peritonitis. This gave an opportunity to examine the pelvis on the skeleton to determine the increase in the pelvic diameters following the operation. It was found that the increase in the anteroposterior diameter was less than in the transverse diameter, while the obliques gained more from the operation than the others. At the time of operation it was found that the bones of the pelvis separated during delivery from 1.5 to 3 cm. At the moment when the head passed, the separation increased to 6 or 7 cm. Laceration occurred in several of the cases, but not to a serious extent.

In the same journal REIFERSCHEID reports from the clinic at Bonn 4 cases of pubiotomy with good results for mother and child. The method of operating was similar to that employed in the preceding cases. The so-called subcutaneous method of Döderlein was used. The operation proceeded as usual and there was very little bleeding on

the cut ends of the bones. In 1 case the bladder was wounded, the bladder wall being compressed between forceps and the sharp edge of the severed bone. In another case the vaginal wall was torn, the laceration extending to the wound in the pelvis. The bones separated after section from 3 to 6 cm. In 1 case separation was very little after the severing of the bone until the fascia and periosteum was completely cut. In 2 cases the child was delivered by version and extraction, and in 2 by forceps. The upper portion of the wound made was closed by suture and the lower portion of the wound drained. The pelvic bandage was removed after about the tenth day, and after two weeks the patient began to get up. Mothers and children made complete recoveries.

On examining these patients some months afterward, in 1 the pelvic bones were found firmly united. In another case the ends of the bone could be distinctly moved from each other.

GYNECOLOGY.

UNDER THE CHARGE OF

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Intermenstrual Pain.—ROSNER (*La gynécologie*, June, 1905) discusses this subject at length, presenting an exhaustive review of the literature. His own observations include 35 cases, most of the patients being multiparæ. He concludes that in every instance of intermenstrual pain there is some demonstrable lesion of the pelvic organs, especially congestion or atrophy of the uterus, or prolapse and tenderness of the ovaries.

Intermenstrual pain may be explained by two theories—either ovulation in the middle of the intermenstrual period, or disease of the ovaries, especially cystic degeneration, the writer being inclined to adopt the latter. While he admits that the endometrium is not in a normal condition in these cases, he does not believe with some authors that this is the cause of the pains. He also rejects the theory that they are due to so-called "hydrosalpinx profluens." In his opinion, intermenstrual pain is really a pelvic neuralgia, provoked by intense congestion due to disease of the ovaries. This agrees with Van de Velde's observations on the menstrual wave in women with ovarian troubles.

The writer has found that most relief is afforded by systematic tamponade of the vagina, begun two or three days before the pains usually appear, although he is not able to explain the real effect of the pressure. Ovarian extract has given good results. Operative intervention is uncertain, unless it is radical—ovariotomy or hysterectomy.

Cancer and Fibromyoma of the Uterus.—PIQUAND (*Annales de gyn. et d'obstétrique*, September, 1905) concludes that the association of fibroids with cancer of the uterus is rare, as he has been able to collect

only 360 cases. Epithelioma may develop in the fibromyoma, or the latter may coexist with malignant disease, either of the cervix or of the corpus uteri. The first variety is exceptional, only 44 instances having been observed. Cancerous degeneration of the fibroid is nearly always secondary to disease of the endometrium, though in 24 undoubted cases it developed primarily from proliferation of epithelial cells in the tumor, or from the transformation of fibromuscular into epithelial elements (?). Pre-existing epithelium may be derived from the included remains of the ducts of Wolff or Müller, or from ingrowths from the endometrium. 179 cases of combined fibromyoma and cancer of the corpus uteri were recorded, the presence of the former neoplasm probably leading to the development of the latter in consequence of the existing chronic metritis.

In 136 cases cancer of the cervix was noted, due, in the writer's opinion, to alterations in the epithelium of the cervix from disturbance of nutrition of the part.

Abdominal hysterectomy is preferable, though the operation is attended with a high mortality and recurrences are frequent.

The natural inference is that fibroids should be removed early, even when they give rise to few symptoms and the patients are near the menopause.

Lymphatic Involvement in Cancer of the Uterus.—KROEMER (*Archiv für Gynäkologie*, 1904, Bd. lxiii.), after a thorough review of the literature of the subject, arrives at the conclusion that cancer of the uterus first extends to the surrounding tissues by direct continuity, the lymph nodes being affected only at an advanced stage of the disease. He prefers vaginal to abdominal hysterectomy in early cases, the paravaginal incision of Schuchardt being useful if the broad ligaments are involved. The abdominal route is preferable in cases of sarcoma, pregnancy complicated with cancer, in unmarried women, and in the advanced stage of epithelioma of the cervix; also where both the cervix and corpus uteri are involved. The writer insists upon a thorough microscopic examination of suspicious tissue before a radical operation is attempted.

Ovarian Disease as a Cause of Fibroid.—CAMPBELL (*Scottish Medical and Surgical Journal*, 1905, No. 5) advances the theory that since disease of the ovaries is a common accompaniment of uterine fibroid, and hence that ovulation is frequently suspended (?) as in pregnancy, it is possible that such ovaries may produce an abnormal internal secretion which acts upon the uterus in such a way as to cause an irregular hypertrophy of its tissue, especially the connective tissue. This theory, he believes, agrees with the well-known development of fibrous nodules around dilated vessels.

[This theory assumes that the ovarian disease precedes the development of the fibroid, which is by no means demonstrable.—H. C. C.]

Eucaine and Adrenalin in Gynecological Operations.—FREUND (*Zentralblatt für Gynäkologie*, 1904, No. 48) used subcutaneous injections of 1 or 2 parts of 1:1000 adrenalin and 8 or 9 parts of 1 per cent eucaine solutions. Not only is the local anæsthesia perfect, but hemorrhage is slight. The effect is most marked in operations upon the vagina, less satisfactory in the perineal region, and absent in operations on the cervix uteri. From ten to fifteen minutes are necessary to secure

complete anæsthesia of the perineum. During the past year the author has used this local anæsthetic in all his plastic work, especially in cases of prolapsus when laparotomy is not indicated.

The Mesometrium in Cancer of the Uterus.—THEILHABER and HALLINGER (*Archiv für Gynäkologie*, 1904, Bd. lxxiii.) examined the uterine parenchyma in 20 cases of uterine cancer. In all there was marked hypertrophy of the mesometrium. In 16 cases of cancer of the cervix the muscular wall was hypertrophied in 8; in 4 there was marked hyperplasia of the muscular tissue; in the others of the connective tissue. There was no appreciable change in the endometrium, except in one instance; 12 cases of intracervical cancer showed accompanying disease of the body of the uterus—a strong argument against high amputation.

Premenstrual Congestion of the Thyroid Gland.—LE ROY and DELAFOSSE (*Jour. des sciences méd. de Lille*, March 3, 1905) report the case of an anæmic young girl with amenorrhœa, who had a marked congestion of the thyroid, which occurred at the time when the menstrual flow should have appeared and lasted for eight days, attended by a marked viscus. They argue from this a close relation between the gland and the function of ovulation, even when menstruation is absent.

Injections of Paraffin in Prolapsus Uteri.—BARDEBBEN (*Mediz. Blätter; La gynécologie*, 1905, No. 3) reports 12 cases treated in the following manner: The vagina is tamponed with gauze saturated with alcohol and xylol, after which melted paraffin is poured in and tightly packed in place as it cools, with a spatula. If there is a discharge from the uterus its cavity is first cauterized with nitrate of silver. It is important that there should be no lesions of the vaginal mucosa.

The treatment is only palliative and is not intended to take the place of surgical intervention.

Curability of Cancer of the Uterus.—RUNGE (*Therapie der Gegenwart*, 1905, No. 6), in reviewing the records of the Göttingen Clinic for ten years, found that 0.47 per cent. of all patients suffered from uterine cancer, while in his private clinic the proportion was 1.27 per cent. Of the former patients, 26 per cent. were operable.; of the latter, 52.3 per cent., due to the high intelligence of the better classes.

The primary mortality after operation was 13 per cent.; 61 per cent. remained well for five years. Comparing the number of operable cases with the cures, the percentage was 14.8; or, considering also the primary mortality, 12.9 per cent.

Conservative Myomectomy.—MARTIN (*Zentralblatt für Gynäkologie*, 1905, No. 41) reports 280 operations, with a mortality of 5 per cent. In 12 cases new tumors developed, 8 patients having such severe symptoms as to require a second operation. The writer has found that the preservation of the function of menstruation and the possibility of conception more than offset in the patient's mind the fear of a second operation. The fear that rupture of the parturient uterus may occur after myomectomy need not be entertained, since conception rarely follows the operation. The pains which persist after the conservative

operation are due to disease of the adnexa or endometrium. The writer always opens the uterus and treats the diseased mucous membrane.

Primary Cancer of the Clitoris.—JACOBY (*Monatsschrift für Geb. u. Gyn.*, 1904, No. 19) has collected 40 authentic cases, 25 others being doubtful, and adds 2 which came under his own observation. In the first case the patient being fifty-six years of age, recurrence took place in the inguinal glands two years after ablation of the clitoris; in the second there was no trace of disease two years after operation.

OTOLOGY.

UNDER THE CHARGE OF

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Examinations of the Ears of Railway Employes.—SACHS (*Archiv f. Ohrenheilkunde*, Band lxv., Heft 1 and 2) presents statistics obtained from the examination of the ears of 376 trainmen on the Prussian State Railroads. He divides these railroad employés into two classes. The first class includes conductors, baggagemasters, guards, and brakemen, and the second class the locomotive firemen and engineers. Of the first class 155 were examined; of the second 221.

Of 155 of the first class, 99, or about 60 per cent., had normal hearing; 42, about 32 per cent., had slight ear affections, which could have no effect on the efficiency of their service, and only 14, or about 8 per cent., had the hearing greatly decreased as the result of middle-ear or labyrinth affections. This small percentage is what would be expected among employés in other occupations, and Sachs therefore concludes that the employment on trains (not including that of locomotive firemen and engineers) does not materially affect the hearing.

The conclusions arrived at from the examination of employés of the second class, namely, firemen and engineers on the locomotives, were, however, quite different; 115 firemen and 106 engineers were examined. On the railroads, the employés of which Sachs examined, an apprenticeship in the machine shops of several years is required of the firemen on the locomotives. Therefore, in considering the effect of occupations on the hearing in the case of the firemen, it is probable that the exposure to loud noises, in enclosed spaces during this apprenticeship, had a deleterious effect. Of the 115 firemen, 73, or about 60 per cent., had normal hearing with normal condition of the ears objectively; 30, or about 25 per cent., had a slight diminution of the hearing resulting from labyrinth or from middle-ear affections, and only 12, or about 10 per cent., had a considerable diminution in the hearing. (The maximum hearing distance in this 10 per cent. being 1.5 metres for the whispered voice.)

As the locomotive engineers serve previously as firemen, more unfavorable statistics would be expected from this class, but it was also found that the frequency and gravity of the ear affections corresponded to the length of time of service. Of the 106 engineers, 51 were under thirty-five years of age, 24, or about 48 per cent., had practically normal hearing; 23, or about 45 per cent., had a moderate degree of disturbance of hearing, and only 4, or about 8 per cent., had labyrinth affections in a marked degree. The 55 remaining engineers were over forty-five years of age, and of these, 5, or about 7 per cent., had practically normal hearing; 26, or about 47 per cent., had moderate disturbances, and 24, or about 46 per cent., showed severe labyrinth affection. It was also found that among the engineers and firemen about 25 per cent. showed, on examination of the nose and pharynx, an evident atrophic condition of the mucous membrane, probably due to the influences of coal-dust and atmospheric changes, to which these employés are exposed.

Injuries of the Drumhead.—Passow (*Injuries of the Ear*, Chapter iv., Wiesbaden, 1905), in his exhaustive work upon the general subject of the injuries to which the human ear is liable and the surgically applicable remedies, holding to the theory of Helmholz in regard to the functions of the drumhead and ossicles for the transmission of sound waves, draws attention to the compensatory provision by means of the substitute function of repair tissue, of which the injured drumhead gives striking evidence, and to the fact that while the drumhead is not absolutely essential to hearing, it plays an important part in the transmission of sound waves adequate to the limits of sound perception.

The drumhead may be injured by either the direct or the indirect application of force, the former category including superficial lesions, solutions of continuity, without rupture of the superficial dermoid layer, and completely perforating wounds, and the latter complete ruptures resulting from aerial concussion or from direct injuries to the skull.

Ruptures of the drumhead were found to constitute, in proportion to all observed cases of ear disease, by Schwartze 1 per cent., by Bezold about 0.43 per cent., by Chimani 1.07 per cent., and by Treitel 2.16 per cent., a difference in proportion explainable by the sources from which the observed material was drawn and by the character of the investigation; the percentage of Treitel, for instance, being educed in a series of cases coming under forensic consideration.

The direct injuries to the drumhead usually resulted from the introduction, through the external canal, of slender long foreign bodies or from the corresponding inflow of fluids, steam or caustic solutions, and the walls of the canal exhibited evidence of coincident and corresponding injury.

Manipulation of the external canal for the relief of itching or tickling sensations by means of hairpins and knitting needles in women, and toothpicks and slender pencils in men were common sources of injury of the drumhead, the impact with that membrane being brought about either by an accidental blow upon the hand or the elbow or by the sudden involuntary muscular movement incident to shock or surprise.

Perforations of the drumhead were also commonly observed in field laborers and woodmen, especially in the seasons of the year corresponding to harvest and tree trimming, and in the hunting season, when riding or creeping through underbrush gave instances of penetration of

the drumhead by slender twigs thrust forcibly into the external canal.

Politzer and Schwartze are of the opinion that the majority of perforations of the drumhead from directly applied force occur in the posterior segment, but Zaufal holds that they occur almost invariably in the anterior portion.

Investigations on the cadaver made by the author serve to confirm the observations of Zaufal and also to explain the reasons for this difference in opinion; straight substances, like straws and twigs, when passed directly into the canal, struck against the posterior canal wall and then glanced forward, striking the drumhead in the region, of or anterior to, the light reflex, while similar bodies introduced along the canal, the tragus having been first drawn slightly forward, as would be the case in the introduction of a hairpin, a pencil, or an earspoon, for the purpose of scratching the canal wall, impinged directly upon the posterior segment of the membrane, which, if firm and convex, in some instances, instead of perforating, reflected the foreign body forward against the malleus or into the anterior segment.

In 21 clinically observed cases the different portions of the drumhead were almost equally injured; in 5 cases there were small perforations in the anterior, inferior, and inferior posterior segments; in 1 case in the posterior superior segment and in another in the pars flaccida. In 3 cases the drumhead was torn in all directions as the result of the forcible intrusion of the tip of a tree branch, the irregular end of which tearing through the membrane, had struck against the inner tympanic wall and, rebounding, had inflicted still further injury.

A secondary danger from accidental perforation of the drumhead is that incident to infection, especially when the lining mucous membrane of the tympanum has also been wounded, or when portions of the source of injury have remained in the tympanic cavity to awaken a suppurative process. In like manner the perforation of the drumhead from the use of bougies in the tympanopharyngeal tube, of rare occurrence, is liable to the implication of suppuration.

The differential diagnosis between recent perforating wounds of the drumhead and perforations resulting in the course of suppurative disease is easily made, especially where the history of the case is taken into consideration, but, even without this, the presence of blood clots, the absence of signs of prolonged inflammatory process and the contour of the opening serve to make the accidental nature of the perforation clear, but the differential diagnosis between a superficial and a completely penetrating wound is much more difficult by ocular inspection alone, especially if the opening is small and has become closed by agglutination of its edges and their partial concealment by blood clot. Inflation of the middle ear will provide a means for determination of the real extent of the injury, but if agglutination has been effected, all manipulation, except such as is of a protective character, is contraindicated.

Where there is excessive bleeding, sufficient to furnish an outflow from the canal and to which there is no contribution from a wound of the canal wall, injury to the vascular lining membrane of the tympanum may be inferred with the possibility of its being confirmed by a later serosanguinolent oozing.

The subsequent diagnosis of injury to the drumhead is not difficult

because of the dried blood crusts upon the membrane which often persist for a considerable period after healing has taken place, but in the subsequently infective inflammatory cases the diagnosis is more difficult and the determination of an accidental injury to the drumhead, as a preliminary to the suppurative disease, must be supported by the history of the case and the evidences of concomitant injury to the canal walls.

The moment of penetration of the drumhead is usually marked by a sharp pain and a sensation of cracking or breaking and followed by a sensation of dulness on the corresponding side of the head and by a subjective sound in the ear, the hearing power of which is immediately affected, the decrease in hearing becoming more marked with the subsequent swelling and infiltration of the tissues; the further accompaniment of vertigo as a symptom may be taken to indicate a concussion of or injury to the labyrinth.

That the drumhead is exceedingly sensitive to chemical and thermic irritation also is evidenced by the degree of congestion induced by these means, and where the heat or caustic irritation is excessive by the protective exudation of serum or blood beneath the dermoid layer.

Very hot water or steam may produce a general congestion with subsequent exfoliation, while caustic substances and hot metals are liable, in addition, to produce a direct solution of continuity. The pain accompanying such injuries is usually severe and is best stilled by the instillation of a cocaine solution; hemorrhagic blisters usually resorb their fluid contents and become dry crusts, which are later disposed of by the normal progressive movement of the dermoid coat of the drumhead, but if large, should be punctured by means of a paracentesis needle and their contents evacuated. As a rule, the injuries resultant from chemical and thermic causes heal most readily, so far as the drumhead is concerned, when the natural reparative process is least interfered with.

Injuries from the indirect application of force, aerial concussion, and translation of force from the cranial bones are accompanied usually by a greater degree of disruption of the drumhead than is incident to injuries from direct violence, while the minor effects of this form of injury vary greatly in their objective symptoms from superficial tears and ecchymoses, which take care of themselves, to longitudinal ruptures extending completely across the membrane.

In 48 cases of rupture of the drumhead by indirect violence observed by the author in 44 patients, the injury resulted, in 31 cases, from a box upon the ear or a blow with the naked hand, 2 followed blows with pieces of wood, 1 resulted from the falling of a weight upon the ear, 3 came from falls upon the corresponding side, 3 from bathing and diving, 6 came from detonation close to the ear, 1 came from catheterization of the tympanopharyngeal tube, and 1 from sneezing.

The majority of injuries occurred in the left ear and in men, for easily explainable reasons.

The changes observed in the drumhead as the result of detonating concussion are especially interesting and dependent for their extent upon a variety of conditions, including the proximity of the detonating body to the ear, the duration of the concussion, and the direction from which it approached the ear.

Examinations of the ears of 51 foot artillerymen, both before and

after shooting, were made by R. Müller, the guns being the ordinary 12 cm. field pieces and 15 cm. nickel steel guns. Notwithstanding the fact that the ordinary precaution of stopping the ears was observed and that the men stood at the rear of the pieces behind earthen walls from 3 to 5 metres distant, the effects of the concussion upon the ears were objectively determinable in 44 of the 96 ears examined; in no case was there rupture, but there was injection of the bloodvessels of the drumhead, especially of the manubrial plexus, and sometimes also of the inner end of the external canal, while in 6 cases there were minute ecchymoses, and in 1 case a large dark-red effusion below the malleus.

Of 191 carefully reported cases of rupture of the drumhead collected by the author, including 48 cases of his own, the rupture occurred in the anterior inferior segment in 63 cases, and this region was implicated in 109 cases, while next in order of frequency came the anterior superior, the posterior inferior, and the posterior superior segments; the causes of the injuries being artillery fire, detonation of guns, pistols, and fireworks, caisson work, and diving.

The ruptures of the drumhead which are not infrequently observed after death by hanging are explained by the sudden compression of the pharyngeal walls driving the soft palate upward and preventing exit of the compressed air through the nose, the greater frequency of these ruptures in judicial than in suicidal hanging being explained by the more effective adjustment of the noose and the greater suddenness of the drop in the former instances.

The treatment of ruptures of the drumhead of indirect causation, whether from air compression or from concussion of the cranial bones, is exceedingly simple, on account of the considerable reparative power of the membrane, and consists mainly in removal of or protection from contaminating substances and the permission of the natural apposition of the parts. Where this does not spontaneously occur, apposition may be favored by careful instrumental manipulation, which should be conducted under conditions of rigid asepsis, the normal bleeding from the torn edges of the wound serving as a sufficient dressing.

Gunshot Wounds of the Ear.—A. Passow (*Injuries of the Ear*, Wiesbaden, 1905).—The effect of a gunshot wound implicating the ear is dependent upon the direction taken by the bullet and the force of its impact, the greatly increased penetrative power of projectiles from modern firearms having proportionately increased, in the opinion of the author, the extent and the fatality of such injuries to the ear; projectiles from hand firearms at close range fairly shattering the petrous portion of the temporal bone and at long range penetrating deeply into the bony external canal or mastoid, with corresponding injury to the drumhead and structures of the middle ear. If the external canal is large a shot in the direction of its long axis may pass without deflection and embed itself in the tympanum or the deflection incident to a touch upon the soft tissues of the meatus may result in a concurrent and extensive fracture of the walls of the bony external canal, with equal lack of external evidence of the damage inflicted. With a direct, undeflected passage of the projectile into the tympanum, the injury to the labyrinth is apt to be greater, and the symptoms of general disturbance more marked, and the projectile more apt to have embedded itself in the epitympanum than in cases where it has been deflected and par-

tially arrested in its course by contact with the walls of the external canal.

The immediate symptoms of such an injury, even when there is neither basal nor petrous fracture, are unconsciousness followed by tinnitus, vertigo, and sometimes nausea and vomiting; the ossicles are usually either fractured or dislocated, facial paralysis is not uncommon, and a suppurative inflammation of the middle ear is an almost constant consequence, though this may resolve, even without extraction of the projectile.

In all cases a careful consideration should be given to the general symptoms, and especially to those bearing upon the possibility of a cerebral complication, the question as to whether the projectile is impacted in the petrous portion of the temporal bone, and, if so, where it is located and the extent to which it has become embedded by its own partial disruption being questions often not immediately determinable, especially as even blank shots fired close to the ear may cause extensive ruptures of the drumhead and distortions in the position of the members of the ossicular chain. A coincident swelling of the soft tissues at the inner end of the canal, by no means an infrequent occurrence in extensive wounds of the drumhead and middle ear, may negative the determination of the presence of a projectile or mask its location, and an elucidative answer may have to be sought in the application of the *x*-ray.

The variations in the course of projectiles and the extent of their resultant injury are well illustrated by reference to the general literature of the subject, and the quotations made by the author may be advisedly reproduced.

HUTTIG had under his observation at intervals for several years a man who had shot himself in the right ear with a revolver; the presence of the ball was determined, through a perforation in the drumhead, by means of a porcelain-tipped probe, and was firmly embedded in the petrous portion of the temporal bone; there was absolute loss of hearing in the right ear and a moderate vertigo.

TRAUTMANN'S case was that of a man, aged ninety years, in whom there was visible, through a large perforation in the drumhead, a ball embedded in the tympanum and in contact with the promontory; in this case there was also total loss of hearing, but no vertigo, and in both cases the patients declined operation.

URBANTSCHITSCH chiselled out of the middle ear of a would-be suicide a revolver ball, the presence of which was accompanied by a persistent vertigo; the ball was found to have split into several pieces, the largest being embedded, anteriorly, in the region of the curve of the canal of the carotid, and the promontory was fractured and driven inward, as in a similar case observed by Urbantschitsch. The sequence of the injury was a suppuration of the middle ear, facial paralysis, and total loss of hearing.

ALVOLEDO reports 2 cases accompanied by marked cerebral symptoms. In the first of these the ball was removed by chiselling immediately after the injury, a subsequent syringing, several days later, bringing away the horizontal, semicircular canal, and other syringings small pieces of bone and lead. Vertigo, nausea, vomiting, and persistent fremitus followed and gradually subsided, the drumhead became replaced by cicatricial tissue, and the hearing, for the watch, rose to

1m., an evidence that the cochlea had escaped injury. In the second case there was an interval of four years between the injury and the operation for removal of the bullet, following which there was entire relief from a persistent vertigo, general malaise, and occasional epileptiform attacks.

ORNE GREEN has reported 4 cases, 2 of which resulted fatally; in 1 case a splinter of the bullet had penetrated the brain through the tegmen tympani, and in the other the tegmen was fractured.

In a case reported by MENIERE, a revolver bullet, after lacerating the canal wall and the drumhead, passed downward and forward into the nasopharynx and was expelled with a clot of blood; there was a resultant paralysis of the facial, but the remaining portion of the tympanum and the labyrinth escaped intact.

In the case of a man who fired two revolver shots into his right ear, in an attempted suicide, a ball was extracted a week later, no attention being paid to the assertion of the patient, who was suffering from delirium tremens, that there must be a second bullet in the ear. As the patient grew steadily worse, he was transferred from the main surgical ward of the hospital to the aural ward, and careful examination revealed the presence of the second bullet firmly embedded in the tympanum.

By reflection of the auricle forward, the bullet was removed entire, together with a fractured portion of the anterior bony canal wall, but the radical operation had to be deferred, on account of the unfavorable condition of the patient. When this was done twelve days later it was found that the malleus had been displaced downward and the long process of the incus fractured; recovery was uneventful, but there was total loss of hearing in the right ear.

ROLLIN operated, by reflection of the auricles forward, on a man who had shot himself with a revolver in both ears. Four weeks after operation there was a supra-auricular abscess on one side and on the other paralysis of the facial; on this latter side, the left, there was also injury to the carotid artery.

With the opinion of BERNHARDT, that the operative removal of the projectile should depend upon its location and upon the subsequent appearance of disturbing symptoms and the possibility of a disastrous hemorrhage, the author disagrees and declares himself unquestionably in favor of operative interference on the ground that, despite the evidential cases of tolerance, in which the bullet has remained in the tympanum for years without untoward results, the presence of such a foreign body favors the possibility of middle-ear infection, either through an open drum-head or the natural channel of the tympanopharyngeal tube, with especial liability to extension of the infective process from a cavity which has been more or less injured by the inceptive accident. To defer operation until its imperative demand by the incident of a suppurative process may sometimes prove to have deferred it too long, while the cases of Avoledo show that disturbing symptoms of long duration have been relieved, and were, presumably, previously relievable by extraction of the foreign body.

The procedure for removal of the projectile will be more or less extensive in proportion to its location and the degree of injury which it has caused in its passage; if it is situated in the neighborhood of or in contact with the jugular or carotid, removal is all the more indicated, as subsequent suppuration and caries entail the dangers of thrombosis and

of hemorrhage; in any event, the extraction should be effected only by a practised hand, guided by knowledge of the normal structure of the injured region and of the conditions indicating the extent of operative interference.

Bullets which have been arrested in their course in the external canal are usually removable through the medium of that channel, but, in the great majority of cases, it is necessary to reflect the auricle forward, in order to get a larger operative field and to secure access to the often erratic path which the projectile has followed.

In the majority of cases, moreover, even when the bullet has traversed the intact canal and embedded itself in the tympanum, the operation for opening the tympanum employed in cases of chronic suppurative middle-ear disease should supplement the reflection of the auricle forward, the extent of removal of bone being governed by the location of the projectile, its size, and the degree to which it has become deformed by its contact with the penetrated tissues. The extracted bullet should be carefully examined, to see if its mass has been entirely removed, and where this is a matter of doubt the retroauricular wound should be left open, as also in cases where there is a question of injury extending beyond the region of operation, until the subsequent course of the case proves this to be no longer necessary, the patient, in the mean time, being kept under observation.

DERMATOLOGY.

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The Etiology of Infantile Eczema.—HALL (*British Journal of Dermatology*, July–August, 1905), who has carefully studied 60 cases of infantile eczema, with a view of learning, if possible, the etiological factors concerned, is of the opinion that neither dentition nor vaccination play any part in the production of this disease; nor does he find any support for the theory of an inherited diathesis. He likewise finds the evidence in favor of the causal relationship of digestive disturbances or malassimilation to this variety of eczema insufficient; on the contrary, there is considerable evidence which is strongly opposed to the theory of such relationship. In most cases there was no history of digestive disturbances having preceded or accompanied the eruptions; neither rickets nor malnutrition were present in any considerable number of cases, most of them being breast-fed at the time of the appearance of the eruption. The author regards external irritation as being one of the most important etiological factors, and endeavors to show that the infant is exposed to many new surroundings which may

act as irritants; that exposed parts are in almost all cases the starting-point of the eruption; that the skin reflexes are more widely distributed and more easily excited in the infant than in the adult, and that most of the 60 cases observed began in the colder seasons of the year. He suggests that what is called eczema is a form of reaction of the neuro-cutaneous apparatus to external irritation, which is not present in most people.

Cutaneous Ankylostomiasis.—W. DUBREUILH (*New York Medical Journal*, May 20, 1905, p. 1025) has investigated the literature of this subject, and arrives at the conclusion from the observations made that the disease known as "ground itch" is caused by various forms of ankylostoma, the larvæ of which are to be found in the soil.

Lichen Pilaris seu Spinulosus.—H. G. ADAMSON (*British Journal of Dermatology*, February and March, 1905) considers under this name a disease met with chiefly in children, especially boys, localized more or less symmetrically on buttocks and extremities, characterized by minute filiform corneous papules arranged in small groups or aggregations. The pathological process is a hyperkeratotic formation at the orifices of the sebaceous glandular ducts. The papules are only slightly reddened, and itching is wanting. It is the same disease formerly described by Hardy, Letars, and Vidal under the name "acné cornée." In children sometimes, and generally in adults, this disease is associated with lichen planus.

Epidemic of Herpes Zoster.—OTTO SACHS (*Dermatologische Zeitschrift*, September, 1905, p. 601) describes an epidemic which occurred in Breslau in 1901, the number of cases observed being 69, 8 of which were H. labialis and facialis, 19 H. progenitalis, 12 H. zoster facialis, 8 H. zoster occipitocollaris, etc. The disease occurred during the period of June to November, and the symptoms were relatively mild, prodromals being wanting or slight. The ages of the persons were from three to seventy-three years, but mostly middle age, women and children furnishing the most cases. The author thinks that the forms of herpes known as facialis and progenitalis should be grouped with the so-called zosters.

The Use of the X-rays in Some Skin Affections.—F. S. BURNS (*Boston Medical and Surgical Journal*, June 22, 1905) refers to the value of this agent in folliculitis, and states that if properly applied it will heal almost every case and cure a large number. Temporary alopecia is desired, and to produce this end he uses a tube having a penetration of 0.5 cm. of albuminum, the rays emanating from such a tube being almost entirely absorbed by the skin. The affected area should be exposed at five inches' distance from the anticathode and applications of five minutes given every other day for five times, after which fall of the hair usually occurred. In the treatment of lupus, the author prefers the use of soft tubes and the production of inflammatory reaction over the affected area, causing necrosis of the diseased tissue. When the dosage is properly regulated the author has never observed undesirable results follow this method, and it presents the advantage of shorter sittings and number of exposures, thus curtailing

the whole course of treatment. Neighboring healthy skin should be well protected with heavy leaden masks. The advantage of excising or scraping diseased tissue prior to the use of the *x*-rays is dwelt upon. The open wound usually heals by granulation in from four to eight weeks, the scar comparing favorably with that of cases healed exclusively under the rays.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

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A Study of the Bacteriology of Pertussis.—M. WOLLSTEIN (*Journal of Experimental Medicine*, 1905, vol. vii. p. 335) presents the results of a bacteriological study of 30 cases of pertussis, with special reference to the agglutination reactions of the patient's blood. She isolated from the sputum of 29 of the cases an organism which resembled the influenza bacillus. It grew only on hæmoglobin-containing media and was morphologically like the influenza bacillus, except that it was somewhat larger. This organism appears to be the same as that isolated by Spengler and later by Jockmann and Krause, who called it bacillus pertussis, Eppendorf.

The blood of the patients from whom the bacillus was obtained agglutinated in all cases the organism in 1: 200 and sometimes in 1: 500 dilutions. Homologous serum always produced the highest and most complete reactions, but serum from pertussis cases reacted on all strains of the bacillus in as high dilutions as 1: 100. Various control experiments with normal sera were negative.

By immunizing rabbits with the organism and with influenza bacilli, it was found by absorption experiments that each organism produced a group agglutinin affecting the other, but that a small amount of agglutinin specific for the bacillus from the cases of pertussis was also produced by that organism.

The Action of Roentgen Rays on the Blood.—LINSER and HELBER (*Deutsche Arch. f. klin. Med.*, 1905, Bd. lxxxiii. p. 479) find that the *x*-ray in its destructive effect upon the blood has an election for the white blood cells. This is particularly true of its action upon the circulating blood. Of the different forms of white blood cells the lymphocytes are least resistant to the action of the rays. Through the destruction of the white blood cells in the circulating blood, as well as in leukocyte-containing fluids without the body, there is formed in the serum a leukotoxin. The injection of such serum into other animals produces a marked fall in the numbers of leukocytes in the circulating blood.

The quality of this leukotoxin stands in direct relation to the numbers of leukocytes destroyed by the action of the *x*-ray. The substance is inactivated by heating to 55° to 60° C. It is transmitted from the mother through the placenta to fœtus. After treatment of the animals by the Roentgen rays a nephritis appears, which is not dependent upon the direct action of the rays upon the kidneys. The *x*-ray has little effect upon the blood platelets, red blood cells, and hæmoglobin content. The coagulation of the blood suffers no change through the extensive destruction of leukocytes. Radium and ultra-violet rays produce no changes comparable to those described.

Iodine as a Disinfectant.—Using as test objects bacillus prodigiosus, bacillus anthracis, and spores, bacillus tuberculosis, staphylococcus pyogenes aureus, streptococcus pyogenes, blastomyces dermatidis, and actinomyces bovis, Dr. Guy C. Kinnaman (*Journal of the American Medical Association*, August 26 and September 2, 1905) conducted an extensive series of experiments on the germicidal action of iodine, which led to the conclusion that in solutions of from 0.2 to 1 per cent. it is far superior to corrosive sublimate, 1: 1000, which failed to destroy streptococci in fifteen minutes, while iodine 0.2 : 1000 killed them in two minutes. Iodine solutions are easily prepared and are stable. Iodine neither coagulates albumin nor forms inert compounds with tissues; it is rapid in action; it possesses remarkable penetrating power, and in effective strength it is non-toxic and non-irritating. For all practical purposes a solution of 0.5 per cent. strength is sufficiently strong.

The Morphology of Cells of Exudates and the Specificity of the White Blood Cells.—Helly (*Ziegler's Beiträge*, 1905, Band xxxvii. p. 171) has made an extensive study of the cells of inflammatory exudates, using both smear preparations and sections for the examination of the exudates, which were produced principally by the injection of several varieties of bacteria into the tissues and serous cavities of animals. He concludes that under the influence of bacterial irritants several different types of cells make their appearance in the tissues during the first twenty-four hours. These cells are derivatives of the hæmopœtic system, among which the adventitial cells (so-called leukocytoid cells and polyblasts), which are identical with the white blood cells of the circulating blood are to be counted. They may be divided into two groups: granular polymorphonuclear leukocytes, and basophilic uninuclear lymphocytes. These groups may again be subdivided, the first into amphophile and eosinophile leukocytes, including myelocytes; the second into small and large lymphocytes, with swollen forms of the last variety. Each one of these cell types bears a peculiar relation to the infection. The changes which are to be noted in these cells are both functional and degenerative. The functional changes in the amphophile leukocytes consist in their phagocytic action toward small foreign bodies and bacteria, while the lymphocytes show active phagocytosis for the leukocytes and other cells, as well as for foreign bodies, strictly exclusive of the bacteria. The degenerative changes in the amphophile leukocyte consist in vacuolization, enlargement, disappearance of the granules, swelling and fragmentation of the nucleus or piknosis after the disappearance of the granules. The granules either undergo dissolution within the cell or are extended from the protoplasm. Com-

plete destruction of the cells occurs through plasmolysis, karyolysis, or coagulation necrosis. In the lymphocytes the degenerative changes are made evident by vacuolation of the protoplasm and destruction of the nucleus by karyorexis. There is little alteration during the first twenty-four hours in the eosinophilic leukocytes. The difference in the biological reaction of these several types of cells leaves no doubt but what the amphophile leukocytes, the eosinophiles, and the lymphocytes are three specific cell types which are not capable of developing one into the other. The transformation of uninuclear to polynuclear cells takes place only within the cell species. According to their phagocytic powers the amphophile leukocytes (microphage) and lymphocytes (macrophages) may be considered as phagocytes of different orders, since the first type may be consumed by the second, while the reverse is not true. The leukocytes appear at the point of inflammation first. The lymphocytes, like the leukocytes, are capable of active movement. The fixed connective-tissue elements take no share in the exudate during the first twenty-four hours.

Germicidal Properties of Soaps.—Experimenting with 1 per cent. and 5 per cent. solutions of a common hard (Marseilles) soap containing no free alkali against staphylococci and typhoid bacilli, DR. A. RODET (*Revue d'Hygiene*, April 20, 1905) concludes that it has a decided disinfectant value. Of the two organisms, the typhoid bacilli were found to be much the more sensitive. Small amounts of the soap (0.2 to 0.3:1000) added to broth cultures of the organisms exerted a certain inhibitory influence on growth, but very much larger doses failed to restrain it completely; and yet both forms placed in the soap solutions were killed. The 1 per cent. solution killed the typhoid bacilli within a few minutes, but against the staphylococci it was far less active, requiring several hours to destroy them. The 5 per cent. solution was much more rapid in action. As with other disinfectants in general action was more rapid at high temperatures (35° to 37° C.). Rodet calls attention to the fact that not all bacteria of the same culture are equally susceptible, some being destroyed almost at once and others requiring considerably longer exposure. In this connection it may be recalled that CONRADI (*Centralblatt für Bakteriologie und Parasitenkunde*, April 27, 1904, Bd. xxxvii., original) has asserted that while soaps appear to have decided disinfectant properties, the soap substance itself is inert, even when mixed with ordinary germicidal agents, but that the addition of certain perfumes causes it to become both antiseptic and disinfectant. In his hands a 10 per cent. solution of a certain perfumed soap proved to possess a germicidal power equal to 1:1000 solution of corrosive sublimate.

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